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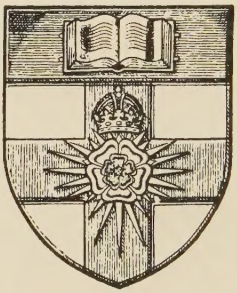

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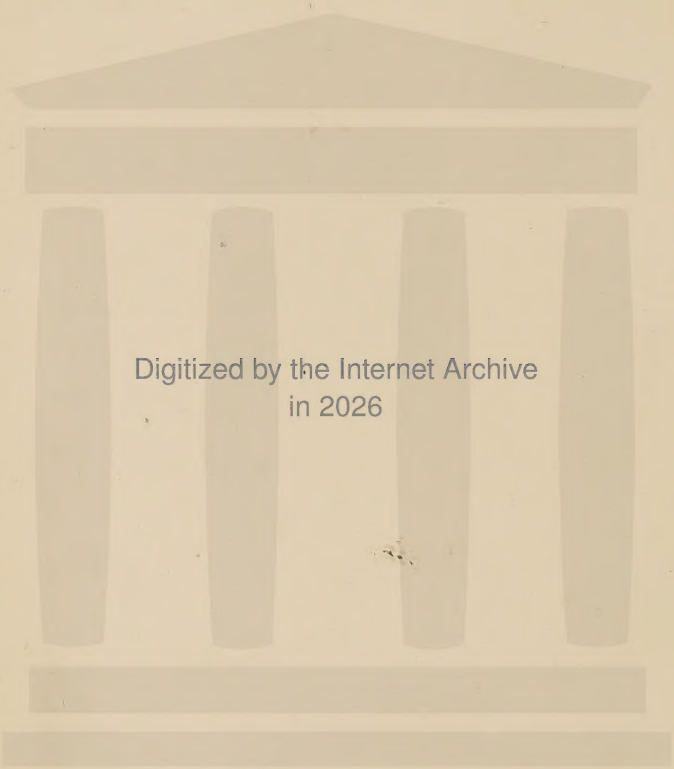
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# THE INSTITUTION OF SURVEYORS.

# TRANSACTIONS.

VOL. X.

SESSION 1877-78.

LONDON:

PUBLISHED AT THE INSTITUTION,

12, GREAT GEORGE STREET, WESTMINSTER, S.W.

[ENTERED AT STATIONERS' HALL.]

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LONDON:
PRINTED BY GEORGE PHIPPS, 13 & 14, TOTHILL STREET,
WESTMINSTER.

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## NOTE.

This Institution does not, as a body, hold itself responsible for statements made or opinions expressed, either in the Papers read or in the discussions which have occurred, at the Meetings.

# The Institution of Surveyors,

12, GREAT GEORGE STREET, WESTMINSTER, S.W.

## OFFICERS, 1877-78.

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*THIS COUNCIL WILL CONTINUE UNTIL MAY* 1878.

# The Institution of Surveyors

Is established—

1. To secure the advancement and facilitate the acquisition of that knowledge which constitutes the profession of a Surveyor, viz.—the art of determining the value of all descriptions of landed and house property, and of the various interests therein; the practice of managing and developing estates; and the science of admeasuring and delineating the physical features of the earth.
2. To promote the general interests of the profession, and to maintain and extend its usefulness for the public advantage.

The Institution consists of three classes, viz.—Members, Associates, and Honorary Members, with a class of Students attached.

A Member must be more than twenty-five years of age, and have acquired a practical knowledge of surveying in one or other of its branches as above defined, and so practised on his own account for more than five years; or be a member of a firm of Surveyors established upwards of ten years; or in partnership with a Surveyor of ten years' standing. Every Member is eligible for election on the Council, for election or appointment to all offices of the Institution, and entitled to all its rights and privileges.

An Associate must be more than twenty-one years of age, not necessarily a Surveyor by profession, but his pursuits must be such as to qualify him to concur with Surveyors in the advancement of professional knowledge. Associates are not eligible for the offices of President or Vice-President, but are eligible for election on the Council or for election or appointment to other offices of the Institution; they have

access to the Library, subject to the regulations of the Council, and are entitled to vote and take part in the affairs of the Institution at all Annual, Ordinary, and Special General Meetings of Members and Associates.

An Honorary Member must be a person who, either by reason of his position or his eminence in science and experience, may be enabled to render assistance in promoting the objects of the Institution, but who is not engaged in practice as a Surveyor in Great Britain or Ireland. He has the privilege of being present and taking part at all Ordinary General Meetings, and of access to the Library, but no right of voting, discussing, or otherwise interfering in the affairs of the Institution; nor is he called on to contribute to its funds.

Students, not under eighteen years of age, may be admitted by the Council on the recommendation (according to a form) of four Members and two Associates, or of the Member or Associate to whom they are or have been articled, and they may remain Students of the Institution at and during the pleasure of the Council, until they attain the age of twenty-one years, when they shall cease to be Students.

The Council may accord to Students such privileges, subject to such terms, regulations, and restrictions, as they shall from time to time prescribe.

Any person desirous of being admitted into the Institution (excepting to the class of Students) must be proposed and recommended according to a form, in which the full name, place of business (if any), usual residence, and qualifications of the candidate must be distinctly specified. This form must be subscribed by him, and signed by at least six Members or four Members and two Associates, certifying a personal knowledge of the candidate.

The proposal so made, being delivered to the Secretary, will be submitted to the Council, who, on approving the qualifications, will determine the class for which the candidate is to be presented for ballot at an Ordinary General Meeting of Members and Associates.

The following are the rates of contribution to the funds :—

| | Annual Subscription. £ | s. | d. | Admission Fee. £ | s. | d. |
|---|---|---|---|---|---|---|
| *Student* | 1 | 1 | 0 | | — | |
| *Associate* | 2 | 2 | 0 | 3 | 3 | 0 |
| *Member* | 3 | 3 | 0 | 5 | 5 | 0 |

An Associate may compound for his annual subscription for twenty guineas, and a Member for thirty guineas.

With the view of forming a Library and Collection, all Members and Associates are expected, within twelve months after their election, to deliver to the Council an original Paper on some subject connected with the profession, or to make a donation to the Library or Collection.

The affairs of the Institution are under the management of a Council, which is elected annually, consisting of a President, four Vice-Presidents, twelve Members, and two Associates. Besides the above, the Past-Presidents, and the President or Chairman of any local Association in alliance with this Institution, are Members of the Council *ex-officio*.

The Session of the Institution commences annually on the second Monday in November, and continues to the end of May. The Ordinary General Meetings are held on every alternate Monday during the Session. At these Meetings original communications are read on some professional subject, and their merits fully and freely discussed. Every Member and Associate has the privilege of introducing one visitor to these Meetings. Members and Associates are entitled to a copy of any printed publication issued by the Institution after their admission.

No. 69.]

# THE OPENING ADDRESS

BY

EDMUND JAMES SMITH, President,

AT THE ORDINARY GENERAL MEETING OF

THE INSTITUTION OF SURVEYORS,

November 12th, 1877.

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Gentlemen,

We enter to-day upon our Tenth Session, and the prosperity of the Institution is now so firmly established as to be beyond all necessity of mention. The Members are constantly increasing, the debt is constantly decreasing, and the effect of the Institution as a centre for the whole body of Surveyors is daily more apparent. The use of this Hall for holding inquiries and arbitrations is so frequent, and the satisfaction which the arrangements connected with it gives to the arbitrators, counsel, and witnesses is so great, that the revenue from this source forms a growing element of our financial prosperity.

One of the Associates of this Institution, who was frequently heard in this Hall, has been elevated to a sphere of wider usefulness since the close of our last Session. I am sure that I speak the sense of the Members of the Institution, when I say that no one here is at all surprised at the selection of Mr. Thesiger as a Judge of Appeal. He will take with him the respect and the esteem and the admiration of all the Members, and their conviction that, in a long career of usefulness, the promise of his earlier years will be fulfilled.

It may be a question deserving consideration, with

reference to our future, whether the admission of Students to a higher grade should not be accompanied by some sort of examination, so that not only their respectability and character should be secured, but that some degree of guarantee should be given to the public that they are not unfitted for the work of protecting the interests entrusted to them. The nature and extent of this guarantee would require grave consideration: if the principle is entertained that, as in both divisions of the Law, some test should be applied in the form of an examination.

The larger portion of our Members is connected with the interests of agriculture, and undoubtedly the past year has not carried out the expectations of those who trusted that the cycle of bad years had terminated, and that this would be the first of the cycle of "fat kine." If, however, we have been wrong in this respect, the belief in cycles of good and bad years has been remarkably confirmed by the recent discoveries of the connection between Indian famines and the variation in the action of the sun through cycles of eleven years' duration. This year has had alleviations in the form of the excellent hay crop, the almost superabundance of pasturage, and in the higher prices of corn. To a certain extent, the moderate yield has been met by the increase of price, and in those exceptional districts where the harvest was got in well, in a brief period, there is no ground of complaint.

As in all previous years, the worst results are found in the heavy clay districts, which depend mainly on the wheat crop, and where the rent bears already the least proportion to the average value of the produce. A small proportion of the value of a fair average course of cropping represents the rent in the arable lands receiving the most expensive, old-fashioned cultivation; and those lands must either be cropped otherwise, or a better method of cultivation must

be pursued as regards the proportion between outlay and money return; though, possibly, more outlay in the first instance may be needed in order to secure a larger produce. It has been said recently that additional capital, to the extent of ten pounds an acre, is requisite to enable the farmers to properly cultivate the lands in their occupation, and that this indispensable capital would be forthcoming if landlords would grant leases without disheartening covenants. I have re-let a considerable number of Crown farms within the last three years on lease for sixteen or twenty-one years, the tenants having in every case ample means, and in each enjoying the shooting and all other privileges on their farms, under satisfactory covenants—and, practically, being masters of the farms for the term of the lease, subject only to the payment of the rent and the maintenance of the cultivation. But I shall be surprised if the most spirited lessee in any one of them profitably employs an additional ten pounds an acre of capital.

There would be no objection to the omission of all covenants as to the course of husbandry except during the last four years of the lease, if the lessee were certain to accumulate capital and survive. Probably the better course is to insert the covenants, and to authorize their suspension. Without mutual confidence between the owner and the lessee, there is not entire security in giving a lease; and, if this confidence fail on either side at any period of the lease, there should be a power of reverting to the agreed liberal course of husbandry. Since writing the above, I have had the opportunity of seeing, in the recently published number of the "Royal Agricultural Society's Journal," that Mr. Gladstone, on his farm near Broughton Hall, gives the tenant an agreement, under which the landlord has it in his power, whenever he may choose, to enforce the four-fold rotation; while, practically, the tenant

has unrestricted liberty of cultivation. The question of the omission of covenants has recently been pressed upon my consideration, and my decision has been for their retention.

Undoubtedly the classes of farms run down from those of the great landowners, which are well supplied with buildings and cottages, and are well drained, to those of the impecunious landowner under mortgage, whose buildings are wretched and drainage nominal; but no legislation can provide against the existence either of a bankrupt landowner or of a bankrupt ironmaster. In both cases, after a brief period, the property falls into other hands, and the new possessor, whether of the farm, or of the iron-works, or of the colliery, having purchased at a price bearing relation to its state, makes the outlay necessary to render it productive in the highest degree. If it be suggested that entails are an obstacle to improvements in the case of land, the evident reply is that, as a whole, entailed estates are in the best order, and are example estates; and that, where they are not, facilities have been given by Parliament to the tenant for life of the property to borrow money for buildings and drainage, and large amounts have been advanced under the sanction of the Inclosure Commissioners for these purposes.

I mentioned in my paper on "Land," in 1872, that the owner of one of the large estates in the kingdom expended £484,000 on the restoration of the farm-buildings and on draining. It is not inapposite to add that that landowner held an entailed estate, which, on his death, necessarily passed to a distant branch of his family, so that his outlay on its improvement was for the benefit of successors not very nearly connected with himself. As regards leases, although I have always advocated their grant, yet in bad times many landlords can hardly bear to see their lessees gradually losing their capital, and claim the full rents upon a basis which

is not attained; and perceive that, if the lessee be unable to cultivate his farm property from want of capital, the lease must inevitably be broken sooner or later, and that the land may fall into possession in an impoverished condition. We see around us at the present time the working of every kind of tenure, and there is much to be said in favour of the principle of confidence in the landlord being equivalent to the possession of a leasehold term of years.

The provisions for the improvement of land, under the Inclosure Commissioners, were passed many years since, when it was thought desirable to bring into cultivation as much land as possible. Parliament now takes an opposite course. It is deemed more expedient that a wild pasture, with but one inhabited house within three miles, at a level 500 feet below the pasture which is 1,800 feet above the sea, should continue in its natural state than that these acres (over which there is no public road) should be improved. It is thought that common fields of 500 acres, lying against 500 acres of land commonable amongst definite owners, should be partially cultivated, and the common uncultivated, rather than that the whole should be made more productive. It is thought more wise, when dependent on foreign countries for more than half of the corn consumed by the population, to trust to the operations of commerce, and to our command of the seas, for the uninterrupted importation of an adequate supply, than to increase our own productions.

The preservation of commons near populous towns, with due regard to the rights of the Lord of the Manor and of the commoners, commends itself to every one; more especially, perhaps, to the owners of adjacent lands to which an uninterrupted prospect is thereby secured for ever: but discrimination should be used in cases where

there is no population to be regarded, and where the lands are purely agricultural. The balance of advantage may weigh in one case in favour of inclosure, in another against inclosure, and in a third in favour of inclosure under conditions; but a Procrustean rule, that no further common land shall be divided between commoners, can be maintained only until time has been afforded for the full consideration of particular circumstances.

The paper duel between Mr. Froude and Mr. Arthur Arnold, "On the uses," and "On the ab-uses of a Landed Gentry," is calculated somewhat to bewilder men who imagine that writing is intended to instruct. The battle rages, so far as regards large and small farms, around one alleged fact, contended for on both sides as the basis of proof for two opposite opinions: recalling Canning's observation, "That nothing is so delusive as facts—except figures." The fact accepted on both sides is, that wheat lands in the United Kingdom produce forty bushels of wheat, while an equal area in France produces fourteen bushels, and in Belgium nineteen bushels: and the inference is drawn that large farms produce more wheat relatively than small farms. But the accepted fact is either misquoted or inaccurate, for the real statistical fact is, that, instead of the ratio being forty bushels in the United Kingdom to fourteen in France and nineteen in Belgium, it certainly is not more than twenty-six bushels, instead of forty, in the United Kingdom; while the average production of France is more than nineteen, and of Belgium more than twenty, bushels. But no practical man would discuss the relative merits of large and small farms on so uncertain a basis as the average produce of four millions of acres of wheat in the United Kingdom, and seventeen millions in France, and seven hundred thousand acres of wheat in Belgium. It would be indispensable to remember that, while one-half of the total

corn acreage of France is in wheat yearly, only one-third of the corn acreage is under wheat in the United Kingdom, and little more than one-fourth in Belgium; and also to know the proportions of each character of soil in each of the three kingdoms, and a variety of other circumstances affecting the discussion. Whether peasant tenancies or tenancies held by men of capital are best for a country is not to be decided on so narrow a basis, even if the facts had been correctly ascertained. The variation of climate between the three sides of England is one main cause why the large farms lie on the east and south, and the small farms lie on the west side of the island; the amount of rainfall necessarily affecting materially the nature of the cultivation of the land: and other countries must be similarly affected.

We may, I think, take for granted that the price of agricultural labour has returned pretty nearly to its permanent rate. As I stated in my Opening Address last year, the prices of agricultural labour did not rise at all in two English counties between 1790 and 1850, and only rose fourteen per cent. in eighteen counties in that period. The demand for labour in the iron and coal districts in 1873 carried wages in 1874-5 beyond their natural level, and the present dearth of employment in all kinds of manufacture (consequent upon the reaction from the inflated prices of 1875,) has restored them to a level which may be taken as a fair basis for letting purposes. The apprehension of an indefinite rise in the cost of labour does not now constitute a difficulty in re-letting farms.

If the English labourer "had the self-denial, the careful thrift, and the scrupulous frugality of the Flemish, the French, or the Swiss peasant," he would find no difficulty in getting on in life; but we, confessedly, are not a thrifty nation. It rarely happens that a labourer strives hard to

save, as a young man : few examples of juvenile thrift occur in higher grades. It has been said that the refuge of the poorhouse in reserve is one of the reasons of the agricultural labourer's carelessness as to the future ; but, whatever the reason, or the want of reason, this tendency has been imputed to us long before political economy became a science. It has been one of our marked characteristics in the eyes of other nations ; and it would be well if education in thrift formed part of the teaching in the Board schools : and, indeed, in the schools of all classes.

No doubt a better education will tend to decrease that worse than waste in beer and spirits which, if saved, would reduce the poor rates and nearly empty the workhouses, and leave the gaols practically untenanted. The public opinion of the labouring class looks already with less leniency on intoxication. It is not more distant from the present tone of the better classes as to excessive drinking than that of the better classes themselves some fifty years since from their present sense of the infinite degradation of the loss of personal control by drink.

There is a wide difference between agricultural wages and those in the Building trade, where we are told that masons —good, bad, and indifferent alike—earn £100 a year for 55 hours' work in each week. It is almost certain that this rate, as it is above the general level, cannot be permanently maintained, and that labour will flow into the occupation until it is reduced to its relative natural proportion to the rate of wages in cognate occupations. This may be effected at once, by the importation of foreigners, or, gradually, by the overflow from less well-paid occupations ; but no one trade can long maintain, in its own favour, a rate of weekly wages materially in excess of that paid in trades of a similar character. The attempt to raise wages by limiting the output deserves little notice. To limit the output has been attempted, both by capitalists and by workmen when the

demand began to cease to exceed the means of supply, in order to maintain a rate of prices on the high level after the reaction has begun; but, the larger has been the rise, the more rapid and the more severe has ever been the corresponding diminution. That the flood-tide of prosperity is succeeded by the ebb-tide of adversity would seem to be as certain in the rate of wages, whether in the Building trade, or in the Coal or the Iron trades, as is the recurrence of the tides in the ocean.

The increasing facilities for the circulation of labour over all the world imports a new element into the calculation. Our labourers have long been accustomed to go abroad, but now they may be undersold in their own market. The clearest example of the free flow of labour is the immigration of the Chinese into the United States, and the consequent reduction of the cost of productions in those trades to which the Chinese have directed their attention. Their cost of living is so small, and their habits are so primitive, that no Anglo-Saxon can compete with them, and no long time may elapse before their competition will be one of the main factors in the prices of labour. Their number will prevent any great rise in their rate of wages for a long period when once they penetrate into the general market, and their presence will raise a series of questions very different from those which have hitherto agitated the labour market. Whether for good or for evil, those questions will have to be settled, and it will be difficult, after insisting upon admission into the Celestial Empire, to deny to its occupants the right in return to bring themselves and their labour into the United States and into Europe. The effects of steam and of the telegraph have yet scarcely begun to operate upon the uncivilized portion of the earth, and another generation will see the results of rapid uninterrupted communication between the remotest shores.

With reference to probable legislation, the subject of

County Boards was briefly referred to in the Opening Address of last year, and the establishment of such Boards may probably form a considerable step towards improvement in the management of local affairs.

The tendency of legislation for some years past has been to crowd duties upon the Local Government Board—the change of name from that of the Poor Law Board evidencing the intentions of the Legislature with reference to its extended functions—and, although the multitudinous duties of the Board have been satisfactorily performed, it has evidently been extremely difficult to exercise a responsible supervision. The machinery, as might have been expected, is too cumbrous for controlling the minor details of local administration. It is difficult to be either sufficiently prompt or sufficiently sympathetic.

On the other hand, the duties with which Boards of Guardians are entrusted have increased greatly, both in importance and variety, during the last fifteen years. The Guardians are now charged with the administration of the Sanitary and Education Acts—the latter involving some of the most delicate and invidious functions which any body of public men, standing in certain social and business relations to their neighbours, could well be asked to perform, and, looking to the class from which Boards of Guardians are mainly recruited, to the intricate nature of some of their duties, and to the large amount of money that they are empowered to raise and expend, it would appear to be time that some new arrangements should be made. Some of the best members of the Boards might be associated with a definite number of magistrates to form a County Board, which, thus constituted, would command the respect of the ratepayers, and, from the larger circle from which its members would be drawn, be in a position to deal in a comprehensive spirit, and possibly in a less costly manner, with local affairs.

The points urged in favour of the establishment of County Boards are—firstly, that, consisting for the most part of elected (though indirectly elected) representatives, they would be likely to endeavour to act in harmony with the wishes and needs of their constituents; secondly, that their formation would probably prove a remedy for the present fragmentary, and therefore costly, systems of dealing with sanitary and fiscal matters, by establishing general rules which would be obligatory on the local authorities; and, thirdly, that, constituted as they would be of men of some influence and social consideration, they would interpose between isolated and comparatively helpless Boards of Guardians and the highly organized but theoretical Central Authority in London.

It was suggested by Mr. Read, in his speech on moving his Resolution in the House of Commons in March last, that two-thirds of the County Boards should consist of persons elected out of the Boards of Guardians, and that one-third should be elected by the Court of Quarter Sessions, presumably out of their own body: and those who hold that the incidence of local as well as of Imperial taxation falls in reality on the owner, contend that, since the magistrates in rural districts pay the greater part of the rates in the form of receiving so much less rent from their tenants, it would only be just that the Quarter Sessions—or, in other words, the property-owning element —should predominate, or, at least, should constitute a large proportion in these Boards. It has also been urged that the election of the non-magisterial element should be direct, and not indirect, as proposed by Mr. Read.

These points will probably afford ground for considerable discussion if any substantive measure is introduced into Parliament. Meanwhile, the adhesion given by the Government to the principle of Mr. Read's resolution points in the direction of early legislation on the subject, and a probable

extension of the duties to be entrusted to the care of County Boards.

The Abolition of Turnpikes has thrown the maintenance of the turnpike roads upon the parishes in which they lie, and the result is most unequal and unfair. It happens not infrequently that such a road runs for miles along the boundary of a parish which is bound to maintain it, while the use of it is by neighbouring towns and other parishes. In fact, the abolition of turnpike trusts was effected without any regard to the incidence of the future maintenance of the road, and attention must be given to the injustice frequently inflicted.

The new Settled Estates Act, which came into operation a few days since, consolidates and amends the previous Acts, and enables "The Court" to deal with settled estates in any way calculated to benefit the life tenant and the successors, even to the extent of the sale of the estates, and the re-investment of the purchase-moneys. The operation of these Acts has now extended over twenty years, and there are few of us who have not had an opportunity of watching their beneficent action, and the improvements they have facilitated. One of the great grievances of past years has been altogether swept away, and free dealing with land secured at little cost so far as settled estates are concerned.

The working of the Artizans' Dwellings Act is progressing satisfactorily; but it is too soon to decide upon its effects.

As I stated last year, future statisticians would possess an invaluable storehouse of information of the agricultural progress made in the last quarter of a century, if another such investigation as that made by Mr. Caird in 1851 could be made, on the same lines, by the same or any other competent investigator. The intervening period has been one of great agricultural activity, and, if the results were registered with reference to the basis of 1851, the two Reports would afford to future agriculturists a broad and

unbiassed view of the state of agriculture in the third quarter of the Nineteenth Century. Such a Report would be especially valuable if a general discussion of the Land Laws should occupy public attention. Mr. Fowler's able Paper, published by the Cobden Club in 1872, stultified itself by adopting as facts the evidence of Mr. Caird in 1851, after the greater part of the objectionable restrictions then existing had intermediately been removed; and other recent writers seem to derive their information from sources which have become antiquated and inaccurate. It is now indispensable to be acquainted with the latest statistics; and almost to keep pace with the telegraph.

The recent number of the Royal Agricultural Society's Journal contains Papers on the Probable Live and Dead Meat Supply from Canada and the United States—a subject affecting the whole of our population as consumers, and a great part of our agriculturists as producers. These Papers, read by the light of the commercial failure of the speculation, appear to me to lead to the conclusion that, while such imports may be sufficient to continue to keep down the price of meat, so far as preventing any very serious rise to the consumer, the margin of profit must ever be so small and uncertain to the importer as to forbid the occupation of any very large amount of capital in the business. Nor do I see that the rapid increase of consumption in the United States, consequent on their continuous increase of population, has been taken into account; nor the almost certainty of a rise of price in the Western States, if a steady and continuous demand for the very best of their cattle (for the very best can alone be sold in England) shall have been established. In any case, we have to thank the Society for having obtained such able and exhaustive Papers for the information of the public, and the facts will receive the greatest consideration from the dairying, the stall-feeding, and the grazing

interests which are likely to be primarily affected by the continued importation.

As a contrast to the grave view I have taken in the first part of this Paper with respect to the heavy clay lands in the Midland and other counties, I will conclude by recapitulating the more pleasant view of farming in the Agricultural Society's Report on the Prize Farms near Liverpool and Manchester.

Except one, no tenant has a lease; and but one is under the Agricultural Holdings Act. Nearly all the farms are within easy carting distance of Liverpool or of Manchester. Rents are moderate—45*s.* to 60*s.* an acre. Four of the eight farms in Class 1 are held under Lords Derby and Sefton (estates probably entailed). Hay and straw are sold and manure purchased; 1,200 tons of Liverpool manure are bought for 326 acres, 700 for 166 acres, 800 tons for 276 acres, 1,000 tons for 222 acres; in addition to artificials. The labour bill is a trifle over £3 an acre, and labourers' wages are 21*s.* a week. The tenants are all industrious, thriving, and contented: though without leases.

Of the three farms in Class 2, each containing between 80 and 150 acres, two belong to Lord Derby and one to Colonel Blackburne. The labour bill on Lord Derby's farms is £1,020 on 256 acres, the purchased manure is 1,300 tons.

Of the four farms in Class 3, each containing less than 50 acres, one belongs to Lord Derby. On the first, containing 45 acres, 400 tons of manure are brought yearly; on the next, of 44 acres, 200 tons are brought; on the others, of 72 acres and 57 acres, the quantity of manure brought is not defined nor can the labour bills be very accurately determined. The tenants themselves do a great part of the labour.

Passing on to the Report of Mr. J. C. Morton (than whom there is no better agriculturist), I find that he

attributes the prosperity of these tenants—1st, to the economy of labour, and, 2nd, to the liberty of the cultivator. Mr. Morton refers especially to the practice of breaking up grass and laying it down again without injury to the farm, and to the fact of the singular facility with which ploughed land in Cheshire and the adjacent counties becomes good grass. In my judgment, this is one of the main elements in the question, as the same practice adopted on the east side of England would require twenty years to bring the land into even inferior grass, while the time required in Cheshire is four years, after which the land is hardly, if at all, distinguishable from old grass.

This fact, which most of us have ascertained by experience, combined with the facilities for obtaining at little cost any quantity of manure, and for selling at any moment any quantity or kind of produce, renders these farms rather examples of garden culture than of corn farming, and reduces their value as illustrations of the present state of the agricultural interests throughout the country. The district supplies specialities rather than general examples.

The subjects proposed for consideration during the Session commenced this evening are—

The Pruning of Fir Trees,
The Warping of Lands,
The Law of Building Support,
The Selection of Materials for Farm Buildings,
County Boards—their Constitution and Duties,
Oyster Culture,
Sewage Irrigation at Wrexham.

Information and Papers on these subjects have already been promised, and there are others, such as—

The Diseases of Forest Trees, and their Treatment,
The Deep Cultivation of Clay Soils,

The Working of the Artizans' Dwellings Act,
Road Making,
Well Sinking,

which some of our Members are highly competent to deal with, and we trust that such Members will give on those points the advantage of their experience for the benefit of the Institution. The younger Members, especially, have an opportunity afforded to them which was not enjoyed by their predecessors.

Mr. E. Ryde (Vice-President) begged to move a cordial vote of thanks to The President for his interesting and able Opening Address. There was much in it that was well worthy of consideration, and to which he would have been glad, had time allowed, to refer.

The suggested establishment of a test examination for Students desirous of passing into higher grades was, he thought, worthy of attention, but, as The President had said, the matter required to be very carefully considered before any definite course was decided upon.

The Inclosure of Commons—about which so much had been said of late years—was a subject of great importance, but one respecting which much confusion existed in the public mind. Something, however, could be done towards removing prevailing misconceptions, if the Members of the Institution, imitating The President's example, came forward to combat the present ignorant opposition to the inclosure of waste lands.

The President had referred at length to the depression under which Agriculture is labouring at the present time. Well, everything seemed to him to be depressed at this time. If the farmers had to complain of a deficient crop, they had, at any rate, the consolation, that they got an uncommonly good price for their straw.

Allusion had been made by The President to the question of Agricultural Labour. There could be no doubt that the School Boards in the rural parishes had taken away all the plough-boys. The small boys one used to see at ploughing matches were now conspicuous by their absence. He was convinced, however, that boys who began to plough, with a good education, at the age of 14 or 15, were better hands than boys who had been ploughing for years without the previous education which such boys now received.

Mr. E. P. Squarey (Member) had much pleasure in seconding the vote of thanks to The President for his admirable Address. His review of the present condition and surroundings of Agriculture struck him as being most accurate and complete.

As Mr. Ryde had said, a great deal of ignorance and prejudice prevailed among the outside public with reference to the Inclosure of Commons, and special means had been taken for fomenting this prejudice. The views taken by the Commons' Protection Society were of that class which, if only allowed free development, would quietly sink of their own accord to their natural and proper level. The feeling with reference to the subject which had momentary sway would subside, and those lands which might reasonably and properly be applied to agricultural purposes, (as contra-distinguished from land in the immediate vicinity of large towns,) would be inclosed and utilized in the common-sense fashion of past times.

The Agricultural Labour question was one of the most difficult of the present day, and confronted the land-agent, *in limine*, in treating with the tenancy of a farm.

He believed, however, that the difficulty was only of a temporary nature, and that a period would arrive when the

labourer would be paid according to his worth, and not on one uniform scale, irrespective of the value of his services good or bad, as the case may be.

It should be borne in mind that, in the districts of England where the lower scale of wages had prevailed, the agricultural labourer was paid, not what he was worth, but the amount which it was estimated would just keep him off the poor books. There were few living who could remember the time when this wretched system was almost universal—the rule and not the exception—but the present condition of the agricultural labourer (he spoke with special reference to the Southern Counties), had, to no slight extent, resulted from the former vicious system of paying him, not what he was individually worth, but according to a fixed standard which removed all incentive to improvement and personal exertion.

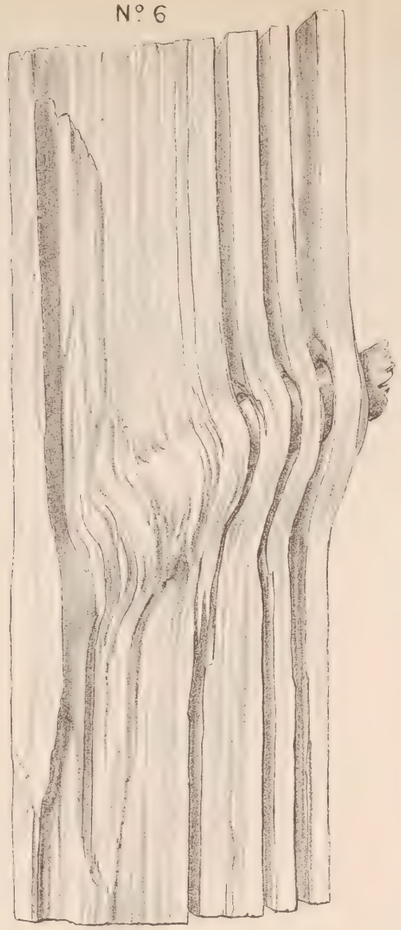
He believed that the time was not distant when the agricultural labourer of England would enter upon a new phase of his existence, and develop a capacity for intelligent and effective labour, and that he, in common with everybody else, would find it most to his interest to earn money by virtue of his own exertion and according to his individual capabilities. The more extensive the application of this system, the better it would be for the farmer himself, and, though the immediate result would be a somewhat larger expenditure, the ultimate result would, he felt convinced, be satisfactory.

The President having briefly acknowledged the vote of thanks, the Meeting adjourned.

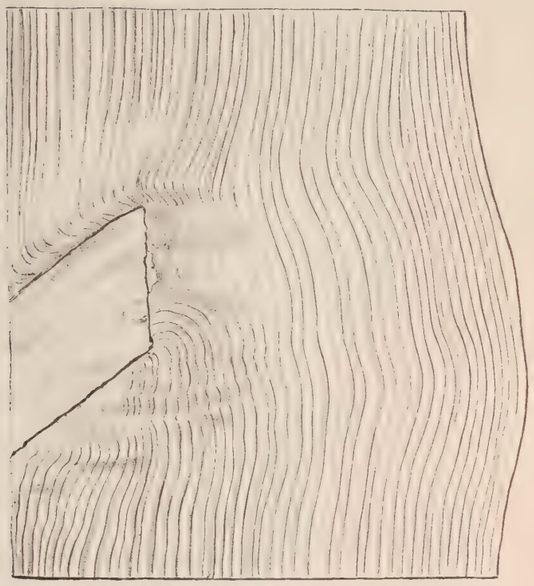
# SPECIMENS OF PRUNED AND UNPRUNED TIMBER.



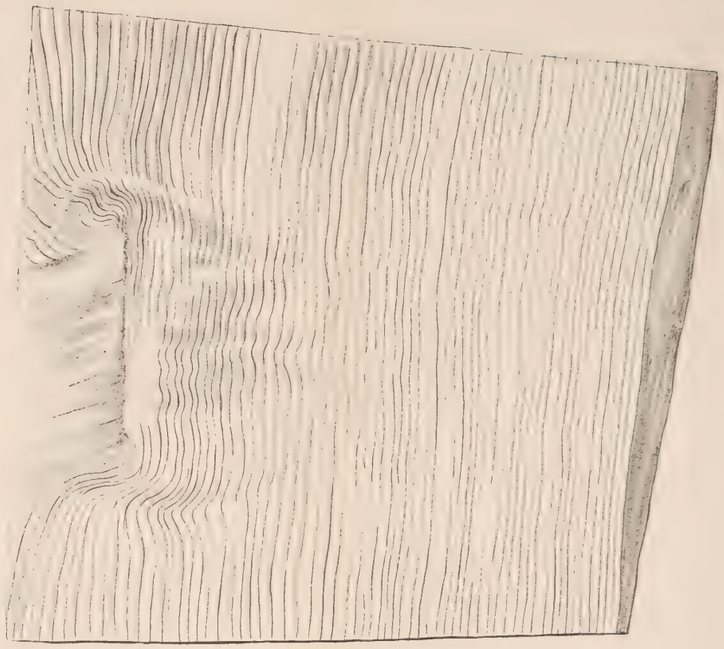
N° 6



N° 4.



N° 3



N° 5.

*Example of unpruned Scotch Timber*

N° 2

*Example of Scotch Timber of 40 years growth pruned at the age of 20 years*

N° 1.

*Example of Scotch Timber of 50 years growth pruned at the age of 10 years*

# DISCUSSION ON THE PRUNING OF CONIFEROUS TREES.

Opened by Mr. CHRISTOPHER STEPHENSON, (Member).

*At the Ordinary General Meeting of the* Institution of Surveyors, *November 26th*, 1877.

THE PRESIDENT, IN THE CHAIR.

In 1873, Mr. William Brown, of Tring, read an interesting Paper, at this Institution, on Beechwoods and Larch Plantations. That Paper dealt with the question of pruning, and the author observed that "*a diseased branch was best removed.*"

During the discussion which followed the reading of the Paper the question of pruning occupied much attention, and in the course of his reply Mr. Brown observed, that "a great deal had been said with respect to pruning. It seemed to him that it would be desirable that two or three persons should each try a piece half pruned and half left to nature, and thus set this much-disputed question at rest."

It was this latter remark which led me to endeavour (with the assistance of the Duke of Bedford's Forester) to obtain examples which, as Mr. Brown hoped, might throw light upon the question of pruning.

As a young Member of this Institution, I think it only right and proper to say that I submit these examples (*exhibited*) and my opinions with diffidence; but, as the

opportunity of showing the result of pruning Scotch timber in Bedfordshire presented itself to me, I thought the matter of sufficient interest to form my excuse for so doing. I would wish you, however, to look upon the discussion which I have now the pleasure of introducing simply as supplementary to the discussion which took place on Mr. Brown's Paper.

I may premise that I shall purposely avoid quoting authorities like Lindley, Loudon, Brown, or others, but briefly confine myself to that which is within my own knowledge and experience.

From the year 1790 to 1810, upwards of 400 acres of land were planted with Scotch fir at a place called Wavendon Heath, on the borders of Beds and Bucks; and about the same time another plantation, chiefly of Scotch fir, was planted at Flitwick, some seven miles distant from Wavendon. The nature of the soil at both places is alike—viz. weak and sandy.

John, sixth Duke of Bedford, was an ardent planter, and took great personal interest in the management of his woodlands. He gave directions that the Wavendon plantation should be systematically pruned, and that the Flitwick plantation should be left unpruned. It was from these two plantations that I obtained the specimens before you.

The instructions of the Duke with regard to the pruning I have named were rigidly carried out, and an old foreman of woods of the present Duke informed me that he assisted for many years in the work, and that the greater portion of it was done from ladders.

The demand for Scotch timber in Bedfordshire has not been active for some years past, but we have nevertheless a small local trade which takes some 15,000 feet annually. Some of the Duke's customers are lath-renders

in a small way of business, and they show much discrimination in procuring the kind of timber which best suits their particular trade; and I can assure you that I have their unanimous verdict in favour of pruning, and in proof of this they are at all times willing to give threepence per foot more for a pruned than for an unpruned tree.

There is a specimen on the table which I procured from a lath-render, showing most clearly why he preferred the pruned tree. I will presently refer to these specimens.

When an unpruned Scotch tree is cut up for rails or boarding it frequently happens that, as the timber becomes seasoned, the knot or root of the branch which has been imbedded by the wood formed since the branch died, drops out, and the rail or board is spoiled. The consequence is that in lath-rending the render has his laths spoilt whenever he meets with an unpruned branch. This I shall be able to show you by-and-bye.

The substance of the discussion on Mr. Brown's Paper in regard to pruning was clearly to the effect that not only was pruning unnecessary, but absolutely wrong in principle. Our experience, however, in Bedfordshire leads us to think that fir trees, Scotch especially, are improved by artificial assistance, and, in fact, the system we pursue is that of assisting nature, and not of controlling her.

Our first thinning takes place when the plantation is of about ten or twelve years' growth, and we then clear the trees of all dead or decaying branches. We continue to thin periodically, according to the growth of the trees, our aim being to give the trees, as they increase in height, the necessary space for their healthy development.

When the trees have attained the height of thirty or forty feet, and stand ten to twelve feet apart, the branches become strong, and if the lower branches as they die and sicken were not removed they would remain upon the

trees for years, and, as long as they so remained, the annual layers of young wood would continue to grow around them. In this way coarse and knotty timber is produced. If the branches of coniferous trees rotted and fell off as quickly as is the case in hardwood trees, then timber free from large knots would be produced without artificial assistance, but as our chief fir buyer said to me a few days ago, "the boughs do not fall off soon enough if left to nature."

I confess that I am decidedly of opinion that coniferous trees, *when grown for profit* are much improved by timely and judicious pruning up to the age of thirty years, and this work should always have careful attention at each thinning.

As soon as the lower branches die or show signs of weakness, so soon, in my opinion, they become of no use whatever to the tree, and should be removed. Cutting off large branches near to the bole of a tree is not pruning, but a practice from which loss must ensue.

The pruned examples on the table show how quickly the wound is healed over, and that a mere scar is left to indicate where the bough was lopped off. Not so, however, with the unpruned tree, for there it is frequently seen that the dead branch has carried a fault (if I may be allowed to use the term) right to the outside of the tree, and it is this fault which does all the damage.

By far the finest and largest Scotch timber in Bedfordshire is upon 100 acres of land, belonging to the Duke of Bedford, within Woburn Park. It was planted in 1743, and was thinned and pruned for many years. Some of the trees have 200 feet of timber in them, and I should say they average 60 feet.

It may be advanced, that our finest pine timber comes from the natural forests of Northern Europe, and that no pruning has ever been attempted there by the hand of man. It must, however, be distinctly borne in mind that these

forests are self-sown ; the plants were indigenous, and did not rise equally—in fact, like the beechwoods in Bucks, there was a succession of different ages springing up thickly around the leading trees, and pruning them in a manner impossible where planting has been undertaken. The comparison, therefore, which has been made, and may be made again, between the old forest timber and that grown from planting in recent times, cannot be justly drawn, simply because the conditions are unequal.

He would now briefly explain the examples of timber exhibited on the table. The first specimen (No. 1)* was from a tree of some sixty years of age, pruned at the age of ten years with a saw or knife. It would be observed that a mere scar was left to show where the branch had been lopped. The timber, in fact, was so perfect that rails or boards entirely free from faults could be cut from it, and it was in the highest degree suitable for lath-rending.

The best example (No. 2) was cut from a tree pruned at about the age of twenty years. He would not, however, recommend that pine timber should be pruned so late, but exhibited this and another specimen (No. 3) in order to show the power which this particular species of tree possessed to cover with sound timber the places where branches had been cut off. The wound, it would be seen, quickly sealed over, and became, as it were, cicatrized, and, after the lapse of a couple of years, the growth of the tree continued uninterruptedly.

A few weeks ago he met a lath-render in the woods and asked him to explain the reason why he preferred a pruned tree to an unpruned tree for his particular purposes. In reply he pointed to a piece of timber, the inner surface of which gave evidence of a branch having once been there. He then sawed off the piece and split it, revealing

* See Sheet of Illustrations after page 36.

a knot resulting from a branch removed when the tree was some fifteen years of age. It would be seen from the specimen in his hand (No. 4) that the tree continued to grow without further injury to the wood. The lath-render was not particular about a few knots in the inside of the tree. He used these inner parts for another purpose, and, as he had said, was quite willing to give 3*d.* per foot more for the pruned than for the unpruned timber.

The next example (No. 6) was one which he had received from a lath-render that morning, and was taken from an unpruned tree. It would be seen that the knot was left untouched, and consequently extended right through to the outer surface of the limb. As shown by this example, each of the laths was in a measure useless. The specimen to which he was referring was a mere chance section of the tree, and it would readily be understood how comparatively useless the laths were when these faults were multiplied throughout the tree. Had this tree been pruned when 10 years old, no such faults would have been found in the timber.

This tree was grown in the Flitwick plantation, to which he had referred. He thought that anyone who bought and cut up that tree would rather have it without the fault caused by the old branch than with it.

The first specimen (No. 1) was a clear example of the advantages of pruning, and showed how different the case was with coniferous trees as compared with deciduous trees. Deciduous trees did not, of course, possess the resinous nature of the coniferous tribe, which enabled the tree to seal over the wound in a few years, and the sound wood to grow over it, as shown in the specimens. The oak, for instance, possessed no resinous secretions, the consequence being the formation of a hole where the limb had been, through which

the water found its way into the tree, and caused permanent injury to the timber.

In introducing, or rather re-introducing, this question of pruning, he had no idea of writing what might in strictness be termed a Paper. His only object was to exhibit examples and explain the practice in Bedfordshire, where they deemed themselves right in the course they were pursuing, and for the reasons he had named.

He would, therefore, be exceedingly gratified if older Members than he, and of larger and more varied experience, would candidly state what they thought of these specimens and of the practice in Bedfordshire. The subject was most interesting and most important, and any light which could be thrown upon it would be of immense value. No work possessed more charms than the management of woodlands, and since the cultivation of one of the coniferous tribe (the larch) was now attended with difficulty in certain districts, it would be readily seen how eagerly advantage would be taken of practical and reliable information.

He would be glad also to learn somewhat more of the practice of others, and, indeed, it was by this way of comparing notes that Members could most effectively help each other, getting their ideas pruned as it were, and their minds improved, by mutual interchange of ideas.

Mr. J. Clutton (Past President) had much pleasure in proposing a vote of thanks to Mr. Stephenson for the interesting specimens which he had brought under the notice of the Meeting, and for the carefully-written Paper with which he had opened the discussion.

He (Mr. Clutton) had frequently expressed his views with reference to the subject of pruning, but any observations he had made referred more particularly to the pruning

of deciduous trees. He was always aware that the pine tribes did not suffer so much from pruning as was generally the case with deciduous trees. It was, he believed, now generally admitted that all pruning of deciduous trees caused defects in the timber, and this was especially the case with the oak. There was a considerable difference, however, in this respect between various kinds of deciduous trees. The elm, for instance, was less damaged by pruning than either the oak or the ash. The specimens on the table were certainly very striking. They no doubt showed that the Scotch fir (he observed that there was no larch among the specimens on the table) very soon became sealed over after the bough was cut off. He could, however, have brought with him from Scotland (had he been aware, before he left it, that this discussion was to take place) specimens of fir timber from very large trees, planted 100 years ago, which he had seen opened, and which were found generally free from the knots to be seen in the specimens on the table. His experience of fir timber extended over a great number of years, and it was his opinion that these knots indicated that the trees were not of very free growth, and that they grew in a poor soil—as well adapted, perhaps, to the growth of Scotch firs as of anything else—but, nevertheless, a poor soil. In Scotland, plantations grew more rapidly, and the effect of the growth was to generally squeeze out the bough which had become useless to the tree, and this was the case also with all deciduous trees, if left alone, and if the trees were healthy and growing ones. Everything depended on this, for there was a vast difference between the habits of an unhealthy and those of a healthy and growing tree. In the one case the branch would decay within the tree and do it injury, while in the other it would be thrown off without damage to the timber.

The specimens on the table were certainly striking.

They showed that the boughing, if done at all, should be done when the tree was young, with a pruning hook, and not when large, with a saw or an axe. They showed also that a certain quantity of sound timber was formed outside the knot.

With regard to the specimen (No. 4), showing where the large bough had been and where the saw mark was still visible, it would be seen on inspection that the actual growth of timber was quite as large or larger before its removal. The lopping of the branch did not tend to increase the rapidity of growth, but only to make the part between the point of excision and the outside of the tree when felled, fit for lath-rending. This particular tree, whether boughed or not, would be very little damaged by the knot, and, even supposing that the knot ran out to the edge, it would be quite fit, if not for fencing, at any rate for ordinary purposes, and the knot would not practically make it unsound

In Sussex and Surrey, most of the laths were made out of oak. He had seen hundreds of oak trees used for that purpose, where the principle followed was never to cut off a bough of any kind, and his experience of healthy, fast-growing trees in Scotland and England was, that they pruned themselves up to a certain age, and that the root of the bough grew out and altogether disappeared in course of time.

He understood from Mr. Stephenson that these boughs were at intervals up to the top of the tree, but in Scotland, where these trees grew large and fast, there was no blemish in them as in the specimen (No. 5) exhibited. In parts of the forests, however, where the trees were not fast growing, these stumps would be seen sticking out, but not when the growth was rapid.

He would be glad to learn, and Mr. Stephenson would

no doubt tell the Members, what the cost of pruning would be in the case of plantations as large as those of many noblemen in Scotland, and what would be the relative values of the trees, pruned and unpruned.

The Scotch foresters performed the operation of pruning, in the first instance, by allowing their trees to grow extraordinarily thickly, planting them about four feet apart, and seldom thinning them till they were of 15 or 20 years growth. The plantations looked badly, but the effect was similar to the use of the knife, the boughs being thrust off before they got to anything like the dimensions of those in the specimens before them; and after the trees grew to the required height, they no longer needed to have the boughs destroyed naturally or artificially.

He admitted freely that the damage done by the pruning of this class of timber, whether Scotch or larch fir, was not equal to the damage done by pruning deciduous trees. If, for instance, an oak were subjected to similar treatment, the tree would be one black mass from the point where the branch had been lopped, down to the bottom of the tree. The wound, although it healed over, would let the water get in, setting up decay which would extend down to the roots. He believed that he and Mr. Stephenson were agreed upon this point. It would be interesting if Mr. Stephenson would give the Meeting an idea of the cost of pruning per acre, and how often the operation had to be repeated. The period of thinning was perhaps from five to six years.

He did not see by the specimens that the growth of the trees was increased in rapidity by the pruning.

Mr. W. Brown (Member) had great pleasure in seconding the vote of thanks, and it was a great satisfaction to him to find that the hint which he had thrown out in

his Paper, in 1873, that experiments should be tried, had been acted upon by Mr. STEPHENSON, and had been illustrated by the interesting specimens shown to the Meeting. Men of far greater experience than himself had condemned pruning of any kind. On referring to the report of the discussion on his Paper, he found that Mr. MENZIES, who followed him, particularly referred to pruning and condemned it. Any one who took the trouble to refer to Vol. V., page 198, of the "Transactions," would find that he did not recommend wholesale pruning, but only pruning at a certain age, and he had certainly found that a tree grew better when so pruned. Only last Friday he requested the four leading woodmen in his employ at the present time, to state what they had observed as to the effects of pruning since he had last inquired of them, and there was not a difference of opinion among them that pruning, to a moderate extent—say, to one-third of the height—most decidedly encouraged the growth of the trees.

He wished the Meeting to remember that he particularly referred in his Paper to larch, for at that time he could not speak very positively about any other kind of fir.

A considerable distinction must, however, be made between timber grown for profit and ornamental timber. After the discussion in 1873, he tried his hand upon pruning what might be termed ornamental timber, or rather upon evergreens, such as Wellingtonias. It occurred to him to try the effect of taking one of the whorls off every year. His experiments did not extend to any great number of trees, but he found that injury resulted to the growth of those thus treated; those, on the contrary, which were left untouched grew very freely and handsomely.

The Scotch fir specimens which Mr. STEPHENSON had

exhibited all convinced him that they might be pruned with advantage. In his part of the country the trees were planted four feet apart, and it would perhaps be contended that they pruned themselves; but he nevertheless believed that, up to a certain growth, they were decidedly benefitted by artificial pruning.

The commercial value of larch was fast increasing, and he could give an instance of this which he had met with, within the last two months, upon an estate of which he had the management. A timber merchant came to him, and said, "If you will cut down thirty or forty large trees," standing in a place which he indicated, "I will give you 1*s.* 7*d.* a foot for them." These trees had been planted within the lives of persons whom he remembered. They were something like 70 feet high, and probably averaged from 10 inches to 13 inches in quarter girth, containing, therefore, 60 or 70 feet of timber. This, at 1*s.* 7*d.* per foot, represented £5 per tree, and he did not know any other species of tree that would bring in a better profit. He might mention one great source of injury to trees at the present time—namely, the squirrels. It was surprising to find, in going through a plantation in the month of May, what damage these animals had done. Some persons liked to see them about, but they were very mischievous, and at the present time he was cutting a vast number of trees which had been damaged by them.

He would add, in answer to Mr. Clutton, that, though the first pruning would cost from 5*s.* to 10*s.* an acre, after 15 years it would pay its expenses.

Mr. G. D. Yeoman (Member) would be glad if Mr. Stephenson would give the cost of pruning per acre, also the respective values of pruned and unpruned timber. He understood him to say that the difference between these

values was 3*d.* per foot, but it would be more instructive if he gave the actual prices in both cases. He would also be glad to learn whether Mr. Stephenson's theory of pruning larch and Scotch firs was, that it improved the quality of the timber, or that trees when so treated grew more rapidly and made more wood in the year than unpruned trees. Perhaps Mr. Clutton would also give the Meeting his opinion on this latter point.

Mr. Clutton replied, that he could only give a qualified answer as regarded the relative quantities of timber yielded by pruned as contrasted with unpruned trees. The actual weight of timber yielded by the unpruned tree would no doubt be somewhat greater than that yielded by the pruned tree, but it did not follow that the greater weight would sell for more money.

He had forgotten to mention the Esher commons. The Scotch fir trees covered about 350 acres. The soil was poor sand land, and the trees had been left almost entirely unthinned and unpruned up to the time when he first had to do with them—now about 15 years ago. He had cut out a great number of the trees, and had seen many of them opened, but very few such faults as were apparent in the examples on the table could be detected in these trees.

One word more with regard to the trees grown in Scotland. The greater part of the timber now cut near to the property where he resided and adjoining estates, was used for tub-staves. Any defects in the timber used for this purpose must be apparent in the staves, vast numbers of which were cut annually and exported, and thousands were lying on the estate at the present moment. He had never seen such defects in these staves as those in the specimens on the table; indeed, it would

be impossible to use the timber for the purpose if they existed to any considerable extent. He believed that an unpruned tree, standing by itself, would have a greater weight of timber than a pruned tree. Not one inch more timber was, he believed, got by cutting off the boughs than by leaving them on.

The cost of pruning (put by Mr. Stephenson at five shillings an acre for a single year) and so on for several successive periods, would, in the course, say, of one hundred years, accumulate at compound interest to a very large sum, and no commercial advantage was gained by the pruning. Of course a certain quantity of lath timber could be obtained, but it must be remembered that all the trees in England and Scotland did not go for lath-making. There were certain woods in Sussex which grew timber better fitted for laths than perhaps any other woods in England, for the timber rended easily and cleanly. This was not the case with all woods. Scotch fir, for instance, grown singly, was as difficult to rend as iron, but trees grown in the mass, either pruned artificially or naturally, were easily rended.

Mr. Stephenson begged to acknowledge the vote of thanks which had been so kindly proposed. He would very briefly reply to the questions which had been asked. He had followed Mr. Clutton's remarks with much interest, knowing how great was his experience in all matters of the kind; but he confessed that he could not agree with him in the particular subject under discussion, and for the reasons set out in his Paper. Particular attention had been drawn by Mr. Clutton to the larger example (No. 3) of the effects of pruning; but he had explained that the specimen was offered rather as a warning than as an example. The branch, in this case, was much too large for pruning, and one, he thought, which no one practically

acquainted with woodlands would think of removing. In the examples which he wished to be followed there were no such signs of injury to the timber, and he could not conceive how any one could prefer the tree grown in the Flitwick plantation (No. 5) to that grown in the Wavendon plantation (No. 1). Both trees were planted at the same time, and were cut under similar circumstances, one, however, being pruned and the other left unpruned. He could not see that the weight of the timber had much to do with the question—as it was simply the weight of the dead bough as against the increased growth of the timber.

It was said by Mr. Clutton that trees would prune themselves; but, unfortunately (at least in Bedfordshire,) they did not do so, and for this reason it was deemed advisable to assist them by artificial means. The examples on the table were all grown on plantations where the trees stood four feet apart, not ten feet, as he had been wrongly understood to say. It was only when the trees had attained a height of from 30 to 40 feet that they stood from ten to twelve feet apart. He would do his best to answer the questions put by Mr. Clutton and Mr. Yeoman with regard to the cost of pruning. The cost would be about 5*s*. per acre, assuming that the pruning took place when the trees were twelve or fifteen years old. The operation would have to be repeated every fifth, sixth, or seventh year. The precise time depended on the kind of plantation, and the nature of the soil. Some plantations could be pruned at ten years, while others would not be fit to prune till fifteen years, or even later. Differences of climate no doubt affected the pine, and in Scotland, where the tree was indigenous, it grew with greater luxuriance, and yielded finer timber. There were certain lands in the south of England which were fit for little else than growing this kind of timber, and in order to do so with any degree

of success it was necessary to adopt special methods of cultivation to meet the altered circumstances.

As regarded the relative prices commanded by pruned and unpruned timber, he might observe that lath-renders in Bedfordshire gave 1*s.* per foot for timber like the better of the two specimens exhibited, but they would not have the other at 9*d.* per foot—in fact, they did not care to buy it at all. Thinning and pruning should, he thought, go on simultaneously.

He would here read, with the permission of the Meeting, two or three extracts from the writings of a gentleman who was well known as a forester—he alluded to Mr. James Brown, who said, "I recommend, therefore, that as the lower branches of the coniferous trees die out—and in plantations they always do—they should be as gradually removed. Were this attended to, woods would not only present a more pleasing effect and be more healthy, but, what is of perhaps greater importance, would be more valuable in their timber at all stages." He confessed that he agreed with Mr. Brown with regard to the promotion of healthiness and rapid growth, and consequently of commercial profit, by means of pruning—in Bedfordshire at any rate, whatever the case might be with regard to Scotland or elsewhere.

In an article in "The Transactions of the Scottish Arboricultural Society," in speaking of nature "as a forester," Mr. W. Brown said, "I have cut up thousands of trees in the Strathspey and Deeside forests. The knots are not large, but numerous, and affect the value of the deals considerably. Some parts of the forests are worse than others in this respect. Nature is, therefore, not a good forester in regard to pruning." Mr. Philip, also referring to the same subject said, "Were it not for the expense, I should recommend the pruning of every Scotch pine tree—that is, cutting clean away every

branch as it dies and dries." LINDLEY also stated, in an article against pruning, that "The system may be regarded as a necessary evil," and considered that thinning and stopping were never done properly, and pruning must be resorted to in order to meet neglect. It was found that nature was bereft of her pruning power where timber was artifically grown—*i.e.*, the indigenous growth of a succession, springing up at different times was absent." That had been his experience.

He thought he could show that the nett increase, when the great fall came, would amount to something considerable. If, as was the case, he could sell the pruned timber at 3*d.* per foot more than the unpruned, what did it mean? It meant, assuming one hundred firs per acre, of 30 feet each, 30 threepences, or 7*s.* 6*d.*, which, multiplied by one hundred, made £37 10*s.* Thirty-seven pounds ten shillings per acre would, at the end of the time, represent a considerable increase in price, sufficient, probably, to more than balance the accumulating interest referred to by Mr. CLUTTON.

THE PRESIDENT was sure that all would concur in the vote of thanks which had been proposed to Mr. STEPHENSON for his very interesting specimens, and his exceedingly able Paper in support of his views. If Mr. STEPHENSON and those who differed from him had failed to convince each other, they must bear in mind that the subject had been under discussion for several hundred years, and had had, during the whole of that period, most able advocates and arguments in favour of each side.

He had referred at that instant to Evelyn's "Silva," and the only interesting fact which he found in it which could be termed an addition to their previous information was, that "the time of the pruning ought to have regard to the age of the moon!"

If he were called upon to give any opinion he should object to any pruning of oak at any period, although the evidence and opinion of Mr. Stephenson led him to think more favourably of pruning fir.

The vote of thanks having been put and carried unanimously, the Meeting adjourned.

No. 71.]

# WARPING.

By T. C. SMITH-WOOLLEY (Associate).

*Read at the Ordinary General Meeting of the* Institution of Surveyors, *December 10th*, 1877.

WILLIAM STURGE, VICE-PRESIDENT, IN THE CHAIR.

I need hardly say that it is with great hesitation that I venture to read a Paper before this Institution, but I am induced to do so because the subject of which I propose to treat is one with which, owing to its very local character, many Surveyors can have but a slight acquaintance.

I purpose to confine myself to night to the subject of river warping, as distinguished from sea warping; that is, the improvement of lands adjoining or near to tidal rivers by the artificial distribution over them of the earthy matter brought up by the flowing tide.

The kindred process of sea warping, natural and artificial, is almost identical in result, and as the mode in which it is carried out has already been discussed in this place, and must be more or less familiar to most of the Members of this Institution, it will not be necessary for me to detain you with any remarks which my own very slight knowledge of this branch of the subject would enable me to make.

What I may call, then, for the sake of clearness, river warping may be divided into two heads: (1) wet warping, in which the tidal waters of the Trent, the Ouse, and the Don (chiefly if not exclusively), all three flowing into that great estuary, the Humber, are artificially conducted over the area required to be improved; and (2) dry, or cart warping, which is the utilization, for the same purpose, of the rich deposit found in the beds of rivers now diverted.

The warping district comprises the north-western portion of Lincolnshire and the southern part of the West Riding of Yorkshire.

In treating of the vast improvement which has taken place by means of this process, I must not omit to mention the man who was the pioneer of all improvement in that district, Sir Cornelius Vermuyden. He and his band of Dutchmen, in the reign of Charles the First, executed vast drainage works in the Isle of Axholme (which forms the north-west corner of the County of Lincoln), the net result of their labours being of enormous advantage to the district; but the violent and persistent opposition which they met with at the hands of the inhabitants, and which I had always supposed was due to the gross ignorance of the natives, as well as to the suspicion and jealousy with which comparatively-isolated people always regard foreigners and innovators, I find on a closer study of the history of their doings to have been, in a measure, justified by the very serious injury which was inflicted in many cases. The diversion of existing rivers and the creation of new drains was not always carried out in the most judicious manner, the result being that many lands which had been previously free from flood were now frequently submerged, to the injury and even ruin of the unfortunate proprietors.

The record of the struggle between the Participants (as the Dutch capitalists were called) and the English proprietors is extremely interesting; but is, I am sorry to say, for the most part, a history of horrible outrages and utter disregard of law on the part of the English, who ultimately succeeded in driving the foreigners out of the country.

Archdeacon Stonehouse's History of the Isle of Axholme furnishes a very "full and particular," and, I believe, in the main "a true" account of this conflict.

So far as I can learn, however, it was not until the

middle of the last century, or even rather later, that use was made of the valuable deposit to any great extent. About that time a Mr. Priestley tried the process on a small scale, and with such good results that he proceeded to warp 500 acres, covering ten acres at a time. The first Act of Parliament was obtained in 1816. By this Act power was given to certain Commissioners to enclose and warp lands in the parish of Crowle. This was followed, in 1820, by an Act for warping and otherwise improving certain lands, moors, &c., in the parishes of Whitgift and Snaith, in the West Riding of Yorkshire. The originators of this scheme were the late Admiral Sotheron and Mr. Creyke, the latter of whom, in the year 1844, contributed to the "Journal of the Royal Agricultural Society" a Paper showing the extent of lands actually warped up to that time from his principal sluice—namely, 3,600 acres.

Mr. Creyke has had numerous successors, notably Mr. Makin Durham, of Thorne; and the area of land which has been improved at this date cannot be estimated at less than 30,000 acres.

The process of wet warping can of course only be carried out in the case of lands lying below the level of the river at high water, but of such land there is a vast area in that part of the country of which I speak—at a rough guess I should say 60,000 acres in all.

To coin a word, "warpable," land may roughly be divided into two classes—(1) those lands which in the days before the rivers were embanked were wont to be covered at high water, and which are of all varieties of soil and subsoil, and (2) lands such as certain parts of Thorne waste, a peat moss of 6,000 acres which, formerly above the high water level, have been so lowered by drainage as now to be below it.

On Thorne waste, warping was carried out to some extent on parts originally below the level of the tide, now

more than a hundred years ago, and at this moment a considerable portion of the higher part of the waste is being drained with a view to reducing it to the necessary level. The peat, which is some twenty feet in depth, is already a yard lower than it was at the commencement of the operation, and, if it can be reduced yet another yard, the object of the enterprize will be attained.

The almost valueless nature of this land in its natural state would lead to its being chosen for improvement before land of finer quality, but this is not the only reason why it should be selected; for this moorish peaty soil becomes, when warped, land of extraordinary fineness.

The process may be applied with great advantage to land of all sorts, good, indifferent, and bad, clay, sand, or peat; but the improvement obtained is found to be least on the strong clay, and greatest on the comparatively worthless peat.

Warping has been carried out very largely in this district; and I have been informed by the largest and most successful warper in the country, that he does not know of a single case in which the result of the operation has failed to yield a fair return on the capital expended.

I will now proceed to give a brief account of the process, which is practically the same throughout the district.

The first thing to be done is to put a sluice or clough into the river bank, varying in size according to the area to be covered at one time and the distance from the sluice of the furthest point.

The following description of a sluice which was used to warp an area of 1,600 acres (given by Mr. Creyke in his Paper on the subject which obtained from the Society of Arts their large gold medal so long ago as 1825) may be of sufficient interest for me to reproduce here. After stating the circumstances under which he undertook the operation,

he proceeds:—"A sluice, with two openings of sixteen feet each, and nineteen feet high, from the sole to the crown of the arch, with substantial folding-doors, was built and opened, and at the same time a main drain was cut, extending from it two miles and-a-half up to the waste land and peat moss. . . . The sluice was built of stone of large size, backed with brick; the foundation was well piled with 550 piles, thirteen feet long, squaring eleven inches, upon which were firmly secured very strong beams; upon the beams the whole space upon which the sluice was built was planked with four-inch deals, another set of beams was placed crossways, and then a second floor of three-inch plank. Sheeting-piles were driven the whole length of the woodwork both fronting the river and next the main drain; a wall was also erected from the sluice to the river, to prevent the bank from being injured." The cost of the sluice and its adjuncts was £5,500, and the area was warped in three compartments of 429, 500, and 671 acres respectively.

There is of course no essential difference between a warping sluice and an ordinary drainage sluice, in fact most warping sluices are utilized as drainage sluices when they have fulfilled the primary purpose for which they were erected.

In choosing a site for a sluice, care has to be taken to select a firm bed, or rather one which is not liable to shift. Peat will make a good bed, although a sluice built on such a foundation will sometimes, when a high wind-lashed tide is beating upon it, vibrate perceptibly, but a sand bed must, if possible, be avoided. In any case the ground must of course be rendered thoroughly secure; if necessary, by piling, and otherwise.

The area is next divided into compartments, and that intended to be warped first is banked in, care being taken to make the bank of about a uniform height throughout. The ground is roughly levelled (when lying but little below

high water-mark), hillocks removed, and either thrown into the hollows or used for the banks. Judgment has to be exercised in levelling, because when the ground rises to a considerable height within a compartment, the cost of removing it will often be too large to warrant such a proceeding, especially where the material is in excess of that required for the embankment, and where no part of the area is much below high-tide level. In such cases, it is usual to leave the hills which rise above high water-mark in their natural condition, and they may often with advantage be planted with Scotch fir, larch, or other trees.

Where the land rises rapidly at the margin of the compartment above the high-water level, embanking is, of course, superfluous.

The banks, which are two or three feet wide at the top, are usually made one and a-half to one batter.

The compartment being embanked, the beginning of the main drain is cut from the sluice, supposing, as is usually the case, that the first section does not lie immediately contiguous to the river, but that there is an interval of land not requiring warping.

Opinions differ as to what should be the proportion of the sectional area of the main drain to that of the sluice, some holding that it should be as three to one, others that they should both be about the same size, and others that the drain should be somewhat larger than the opening of the sluice, on the ground that the spring tides in passing through the sluice may wash against solid masonry without injuring it, but that, if in the drain they were confined within the same space, much injury would necessarily accrue to the bank. This, I think, is a sound argument, and the view which it supports may perhaps be taken to be the correct one.

The sluice gates are then opened and secured, and the tide admitted.

There are usually two or more openings to the sluice, and at first it is best to open only one of them so as to prevent the great pressure of a whole tide from injuring the newly-made banks.

A sort of impression prevails, I think very generally, that when you have got the tide safe inside your sluice, you must shut up your gates to keep it there for a considerable time in order to let the deposit settle. This idea is utterly erroneous, and is not, I believe, carried out in any single instance; indeed, as far as I have observed, sluices are invariably made without any provision for retaining the tide, the doors opening of themselves whenever the water inside is above the level of the river.

The fact is that a single tide leaves so large a proportion of its precious burden in its natural flow and ebb, that it does not pay to lose tide No. 2 while tide No. 1 is taking time to settle.

While land adjacent to the sluice is being warped, all tides may be let in, but, when the operation is being carried on at a distance (some warping drains are five or six miles long), it is found necessary to shut out the neap tides, because, their flow of water being but small, their power of doing good is out of all proportions to their power of doing harm—namely, by leaving their deposit in the main drain, where it is an unmitigated evil. The same objection does not apply to the spring tides, as they have so much force that they are able to clean out the drain themselves during the ebb.

The disposition of the warp over the land requires great nicety. Were the water allowed to flow in in its own way, the result would be that a large portion of the land would be as worthless, or nearly so, when completed, as before, for the tendency of the water is to deposit the valueless material which it contains at the place at which it begins to spread

out over the land, while the lighter and more valuable parts are carried to the farthest limits of the flow. Hence arises the necessity for "inlets," or little embanked channels, by which the water is conducted into different parts of the land. These are altered from time to time, and it is in the adjustment of them, so as to leave the land, when warped, of equal value throughout, that the skill of an experienced warper is found to be invaluable.

The depth to which land is warped varies according to the original level, but the surface of the warp when completed cannot, of course, be higher than the level of the tide at high water. I have seen lands warped to the depth of six or seven feet in some places, with an average depth of four feet nine inches, but where the land in its original state lies but a foot or so below the spring tide water-mark, the warp will of course be very shallow. In one case with which I am acquainted, had the depth obtainable been less than sixteen inches, which is now the minimum depth, it would not have been worth doing, owing to the aridity of the sand upon which the operation was being carried out. A still greater drawback to the warping of comparatively high lands is, that only the highest spring tides will cover them, and thus the process is rendered a much slower one than on lands more favourably situated. Very low lands lying at a distance from the sluice, are also under a great disadvantage, for the water often does not begin to get off until that in the river has ebbed and begun again to flow. It is consequently often necessary to shut out a tide—sometimes more than one, —in order to let the ebbing water travel back from the land to the sluice, which lets it out as soon as the water in the river is at a lower level. Land should certainly be warped to the greatest depth possible, for this reason, that, if the water is shut off, and the land brought into cultivation while it is still much below the high-water level, the drainage is much impeded.

In numerous cases, on the banks of the Trent, it has been necessary to carry the drainage into the river, by means of pumping-engines, at a very great cost, and for this the owners have only to thank their own lack of patience. Had they been content to wait for the return upon their capital until the highest tides would no longer cover the warped lands, a natural outfall could readily have been obtained. I am sorry to think that this is only another illustration of the inferiority of the Nottinghamshire intellect to the Yorkshire, as such cases are of very rare occurrence, if not altogether unknown, on the banks of the Ouse.

The time, too, which it takes to warp a given quantity of land varies considerably. The land to which I have before referred is now completed, and it has been under treatment for three years.

But Mr. Creyke tells of an instance in which a covering of ten or twelve tides upon an area of from ten to fifteen acres left a deposit of an average depth of two feet, and of another in which an area of 160 acres was begun in June and finished in the following January (a period of only seven months) being warped to a depth of from one to three feet; but cases such as these are very exceptional. The process, however, when carried out under average conditions, occupies about three or four years.

The first compartment of an area being completed, the main drain banks are carried right through it, or along its side. The main drain is extended to the next compartment, which in turn is subjected to the process, and so on until the whole area is finished, after which, unless it is required for drainage purposes, or for the conveyance by boat of the produce of the warped land, the main drain is allowed to warp itself up, which, if left to itself, it will very soon do. Should it be again required for the warping of still more distant lands or for any other purpose, a small channel

is cut through the warp and a spring tide admitted; this being repeated (the neap tides being excluded), the bed of the drain will soon be effectively scoured and in as good a condition as ever.

In warping, it is the practice to exclude the tide in flood time, as the deposit brought down by a fresh is of very inferior quality to the ordinary warp. Thus, in a year like 1875, many spring tides are lost.

When the warping of a compartment is finished, and the main drain banked out, the next thing to do, is, in the autumn, to grip it by spade into lands about twelve yards in width, the ridge being turned up as rough as possible (or loosely scattered over the intervening space, which the action of the weather converts into an excellent seed bed), and, in the following spring, oats are sown broad-cast, and the ridge harrowed over. The ground at this period will not carry horses, and the harrowing, both now and after the sowing of the seeds, has to be done by manual labour. The seeds are then sown and treated in the usual way. The primary purpose in sowing oats is to form a protection for the seeds, but they very often yield a good crop. The seeds are pastured for two or three years, and are then ploughed for potatoes, followed by wheat. A four or five course shift is then adopted—namely, wheat seeded, the seeds pastured two or three years, and then potatoes, which are conveyed in large quantities by water to the London market. In some cases the rotation is, wheat, beans, wheat, seeds, potatoes; the extraordinary fertility of the warp making such a course permissible. It is usual to manure for the fifth or sixth crop, but as many as ten or even more crops are sometimes taken off before the application.

The cost of warping varies very greatly according to circumstances, but doubtless, as a rule, the larger the scale of operations the less the cost per acre; and this is owing

chiefly to the very great outlay required in building a sluice; the difference between a sluice to warp 100, and one to warp 500 acres (in cases where time is not a great object) being, comparatively speaking, trifling. A thoroughly well-built sluice, the walls of solid masonry set on piles (of which over 300 were driven twenty-five feet into the earth), the openings giving a sectional area of about 400 feet, cost upwards of £4,000. This, however, included the cost of an arch under the high road, which at that point runs side by side with the river. Wooden sluices, the cost of which is much less, are sometimes used, but they are not desirable, except in cases where the area capable of being warped is small; for a timber sluice cannot be expected to last more than ten years or so, whereas, owing to the large extent of the area to be warped, or other causes, the sluice may be required for a much longer period, or perhaps permanently. Besides the cost of the sluice, the making of the main drain forms a very heavy item in the necessary expenditure. A drain of thirty feet bottom, the banks rising to a height of six feet above the surface of the water, and twelve feet above the bottom of the drain, with a batter of two to one, would cost about £1,200 per mile for labour alone; the banks in this case would be about nine feet wide at the top, and the earth dug from the drain would be exactly the necessary quantity to form them.

The embanking of the compartments is another necessary expense, and varies according to the size of the compartment, the level of the land, and the suitability of the available material. In one case with which I am acquainted, a very large proportion of the compartment being just above spring tide high-water level, the embanking was done by the process of stripping, as it is called—that is, by taking off about two feet in these high parts by means of tramways, and as a result of this the greater part of the area ought to

be successfully warped. This compartment should in other respects be an unusually cheap one, as a railway embankment forms part of one side of it (right to use it for this purpose having been specially reserved by the owners in their conveyance to the Company), and on another side, the ground rising rapidly to a high level, embanking will be unnecessary.

Superintendence also adds greatly to the cost of the undertaking. Where warping is being carried out to any considerable extent, it is necessary to have a man of intelligence, experience, and thorough trustworthiness, resident on the spot as sluice-keeper, with whom rests the responsibility of admitting or excluding the tide, as well as of the general superintendence of the works.

Sometimes a breakage of the banks occurs in spite of all precautions, and such an occurrence is often a very serious one. There are instances, too, of the sluice head having given way, when an enormous amount of damage has been done.

By Mr. Creyke's Act (1st of George IV., chapter 63) for warping, &c., certain lands in the parishes of Whitgift and Snaith, the price to be paid by the proprietors for the warping of their land is fixed at £21 per acre; but Mr. Creyke, in 1844, remarks that this has been found quite low enough. In point of fact the price now usually paid to the engineer who undertakes the work, varies from £21 to £40 per acre, inclusive; but £25 is an average price.

The improvement in rental value varies according to the original value of the land. Thus, in some cases, land worth £5 per acre in fee has been let at 50*s*. or more, after warping, thus giving about 8 per cent. return on capital expended. Some warped land, owing to special advantages of position, fetches as much as £5 per acre rent; but the average rental of lands successfully warped may be taken to be about 60*s*.

"Whence comes this unfailing supply of warp?" This is

an often-asked question which, so far as I know, has never been satisfactorily answered. The obvious explanation, that it is gathered from the rich lands through which the river passes in its course, is, unfortunately, disposed of by the fact that the deposit brought down by a land flood is, as I have said before, always of an inferior quality to that brought up by the flowing tide in its ordinary condition; though I have no doubt that much of the matter in suspension, brought down by the Trent, the Ouse, and the Don, is deposited in that vast warp store, the bed of the Humber, to be returned in time in the form of warp. It has been held by some that the encroachments of the sea along the coast of Yorkshire north of Spurn Head are sufficient to account for the presence of warp in the waters of the Humber; and it may be that they do furnish a contribution, but I think that the main source from which the deposit is derived is to be found in the action of the tide on the soft clay underlying the Lincolnshire marshes, and of which the original bed of the Humber itself is doubtless composed.

I am very anxious to learn whether the waters of any English tidal rivers, other than those I have specified, are charged in the same manner, and whether, if that be the case, the presence of the warp can satisfactorily be accounted for.

I next come to the subject of dry warping, which is now being carried out at Lindholme on Hatfield Chase, a peat moor of about 4,000 acres, in the West Riding of Yorkshire. This moor, which was formerly a valueless morass, was inclosed by Act of Parliament about the beginning of the present century, and the inclosure drains, then made, converted it into firm and passable land. About thirty years ago it occurred to a Mr. Gossip, resident in the neighbourhood, that the bed of the old river Idle (now diverted), which forms the southern limit of the waste, might contain large quantities of rich alluvium or warp, and, on experiment, this

was found to be the case. He at once proceeded to turn this valuable deposit to account by spreading it over the land; and he seems, from the account furnished to the Royal Agricultural Society, to have set about this enterprise with considerable energy. He employed two engines; one, stationary, to raise the warp from the pit, and another, locomotive, to convey the trucks across the waste; and is said, though I do not believe it, to have covered as much as eight acres a day. But, from one cause or another, the undertaking does not seem to have proved a financial success, and after 400 acres of the waste had been improved the scheme was abandoned. A like result seems to have attended the efforts of the (proposed) Lindholme Waste Improvement Company, which was formed in 1865 for a similar purpose, if, indeed, it ever got beyond the production of an elaborate prospectus and list of directors, which I rather doubt.

Two or three years ago, however, Mr. Wright, of Park Lane, near Doncaster, the present owner of the waste, determined once more to attempt its reclamation by means of dry warping. The work has since been pushed forward vigorously under the able superintendence of the lessee, Mr. Waring, and to the great kindness and courtesy of these gentlemen, I am indebted for much valuable information upon this most interesting subject.

The warp store is the bed of the old Idle, once a navigable tributary of the Trent, and the old Torne, both now diverted; and the warp being dug out is conveyed in trucks by means of moveable tramways to those parts of the waste which are to be treated—the plan so often adopted in the well-known process of marling.

When I first visited Lindholme, the trucks were drawn by horse-power, but two locomotives, by Lewin of Poole, have since been purchased, and the work now proceeds at the rate of three acres a week.

Each locomotive draws a train of seven trucks containing three tons of the warp apiece, and at present, while the scene of operations is within about half-a-mile of the warp-pit, about thirty journeys are made in a day.

Half way between the two ends of the single line of rails is a siding, and here one of the engines, on returning with a train of empty trucks, is met by the other with a full train, a change is effected, and the empties are driven back to one side of the warp-pit, just as, on the other side, the filling of a third train is completed, which is then attached to the engine and despatched, the men crossing over to begin at once the filling of the new arrival. The time occupied by the other engine in travelling to the siding to fetch a full train is employed by the men at the further end of the line in spreading the warp.

The main line is laid upon a road which goes straight across the waste, and the branches from it are shifted from time to time, a width of sixty links being covered each time the rails are moved. The rails are laid on longitudinals over cross sleepers, are connected with each other by an ingenious arrangement, which practically prevents displacement—a very necessary precaution, as the peat is of so spongy a nature that the sinking of the ground as the trucks pass over it may be felt at a distance of many yards, and the appearance of the engine as it travels across the waste is most suggestive of a "bad" passage between Folkestone and Boulogne.

Four men would lay ten chains of the roading in a day.

Eight inches was the depth to which Mr. Gossip spread the warp; but the depth now adopted is ten inches, as being better for wheat. The waste is not prepared in any way for the reception of the warp, which is put on the top of the ling or heather, where there happens to be any; indeed, the heather-covered land is found to be the best to warp upon,

as it is firmer than the bare land, and will thus carry the rails and trucks more readily.

The land is drained at first by shallow grips, fourteen yards apart, to carry off the surface water. These are afterwards deepened to about four feet, and three-inch round tiles are laid in them, having an outfall into open dykes of from four to five feet deep cut across the moor; and as the land is warped it is fenced in, in thirty acre fields, thirty chains long, and ten wide, quick being planted and found to thrive remarkably. The land is ready for seed at once, and the full rental return begins in the very year in which the operation is completed. Occasionally land that has been warped in the morning is sown in the afternoon, and I myself saw, on the 29th of November, wheat looking remarkably well, in a magnificent soil, on the very spot where, less than two months ago, was only worth less heather-covered peat.

There are nearly 4,000 acres to be warped, and at the present time about 500 acres have been done, an area of seven or eight acres of the warp having been used—that is to say, one acre of the warp (which is about forty feet deep) covers about sixty acres of the moor.

The extent of the warp bed is about five miles by ten chains, or a superficial area of 400 acres.

The warped land is of extraordinary fineness, and will, in fact, grow almost anything. In wet weather its dryness is remarkable, and in the hottest season it never burns.

The cost of the process differs according to the distance of the operations from the warp bed, but an average of £27 per acre would, probably, cover the cost of digging, conveying, and spreading, including proportion of cost of plant, erection of necessary farm buildings, drainage, and fencing; and a rental return of from thirty-five to forty shillings per acre may be looked for over the whole moor.

The value in fee of the land, prior to the improvement, is about £5 per acre, the letting value *nil*. A small annual sum was sometimes obtained, I believe, for the shooting, but, in point of fact, the sporting, residential, and agricultural advantages of Hatfield Chase have been, hitherto, about on a par; and yet there appears to be no reason why, in the course of a few years, it should not have become a very valuable estate.

The following estimate of the cost of warping, &c., one of the thirty-acre fields will be of interest :—

| | £ | *s.* | *d.* |
|---|---|---|---|
| Warping 30 acres, at £20 . . . | 600 | 0 | 0 |
| Ditching 40 chains at 5*s.* . . . | 10 | 0 | 0 |
| Under-draining { 3-inch tiles, 25,000, at 20*s.* . | 25 | 0 | 0 |
| Under-draining { Labour, at 1*s.* 3*d.*, per chain | 25 | 0 | 0 |
| Coals, at 14*s.*, per ton . . . | 50 | 0 | 0 |
| Oil, at 3*s.* 6*d.* per gallon, waste, &c. . | 5 | 0 | 0 |
| Gates and posts . . . . | 3 | 0 | 0 |
| | £718 | 0 | 0 |

Or £23 18*s.* per acre.

The tiles (as also any bricks that may be required) are made on the estate, and are of good quality, the brick earth being, in fact, strong warp.

Although I believe Hatfield Chase to be an unique instance of the utilization of the warp found in the beds of diverted rivers, yet it is a very common thing for fresh warp, laid up by the river side, to be purchased and carted away to a distance, for the purpose of being spread upon the land to various depths. Sometimes it is laid on to a thickness of less than half-an-inch, and it is even carted away and dried for the purpose of drilling with the seed, very beneficial results being found to accrue from such a use of it.

I cannot close my Paper without referring to one of the

most interesting aspects of my subject, viz.—the chemical analysis of riverwarp.

But as I do not doubt that many are present to-night who are thoroughly competent to deal with this view of the question (which I, unfortunately, am not), I will only quote a few words by Professor Voelcker with regard to the warp from Hatfield Chase, and subjoin the results of his analysis of Nile mud, together with that of two specimens of Lincolnshire warp.

Professor Voelcker says:—"This warp will produce a "soil of a most fertile character, if proper regard to drainage "is taken, for I find in it (*i.e.*, the warp from Lindholme) "all the elements of fertility, in the very best mechanical "condition, and a chemical state of combination in which "clay can at once be of benefit to vegetation . . . . The "warp contains an intimate and most appropriate mechanical "mixture of organic matter, lime, clay, and fine sand. "The organic matter yields a notable quantity of ammonia "in decomposition, and the mineral substance contains a "good deal of potash, and an appreciable amount of phos-"phoric acid . . . . . The Lindholme warp resembles "intimately in composition Nile mud, which I analyzed "some time ago, and which is noted for its fertilizing "properties."

Analysis of Warp.—(I).

| | | |
|---|---|---|
| Organic matters - - - - - | | 6·927 |
| Soluble salts of river water, 1·473 | Chloride of magnesium - | 0·105 |
| | Chloride of sodium and potassium - - | 0·939 |
| | Sulphate of magnesia - | 0·176 |
| | Sulphate of soda - - | 0·313 |
| Carbonate of lime - - - - - | | 8·177 |
| Carbonate of magnesia - - - - | | 0·312 |

| | |
|---|---|
| Sulphate of lime | 0·104 |
| Alkalies from decomposed silicates | 0·469 |
| Lime | 0·677 |
| Magnesia | 2·604 |
| Oxide of iron | 5·052 |
| Alumina | 8·177 |
| Oxide of manganese | traces |
| Perphosphate of iron | 1·040 |
| Silicic acid | 9·062 |
| Sand, undecomposed silicates, &c. | 55·866 |
| | 100·000 |

### Analysis of Warp.—(II).

Mud taken in front of Sluice on the Lincolnshire Coast.

At 300° F.

| | |
|---|---|
| Moisture | 33·06 |
| Dry Matters | 66·94 |
| | 100·00 |

### Analysis of Dry Matters.

| | |
|---|---|
| Organic matter, water of combination | 3·96 |
| (Containing Nitrogen ·11, equal to Ammonia ·12) | |
| Oxide of iron | 3·41 |
| Alumina | 3·75 |
| Carbonate of lime | 9·69 |
| Magnesia | 1·92 |
| Potash and soda | ·58 |
| Chloride of sodium | ·04 |
| Phosphoric acid | ·12 |
| Insoluble matter (chiefly fine sand and fine clay) | 76·53 |
| | 100·00 |

## Analysis of Nile Mud.

(*See* Report of Royal Agricultural Society, Vol. XXV., p. 237.)

An imperial gallon of the water taken at the beginning of the rise contained—

| | Grains. |
|---|---|
| Suspended matter - - - - | 23·83 |
| Soluble matter - - - - - | 17·87 |

The suspended matter consisted of—

| | |
|---|---|
| Mineral substances (fine clay and sand) - | 20·89 |
| Organic matter (containing nitrogen ·11, equal to ammonia ·13) - - - | 2·94 |

The clear filtered water left, on evaporation, when dried at 300° Fah., 17·87 grains of dry residue, which on analysis produced—

| | | |
|---|---|---|
| Organic matter - - - | 2·12 or 11·4 | per cent. |
| Oxides of iron and alumina, with traces of phosphoric acid - - - - | ·07 or ·4 | „ |
| Silicate of lime - - - | 1·85 or 9·9 | „ |
| Carbonate of lime - - - | 4·36 or 23·5 | „ |
| Carbonate of magnesia - - | 2·81 or 15·1 | „ |
| Carbonate of potash - - | ·66 or 3·6 | „ |
| Carbonate of soda - - | 3·26 or 17·6 | „ |
| Chloride of sodium - - | 2·30 or 12·4 | „ |
| Sulphate of potash - | 0·93 or 5·1 | „ |
| Nitrate of potash - - - | ·18 or 1·0 | „ |

An imperial gallon of Nile water taken at the flood, after standing for a considerable time, deposited 87·51 grains of solid matter, which consisted of—

| | |
|---|---|
| Mineral substances (extremely fine clay and sand, containing a great deal of oxide of iron) - - - - - - | 81·66 |
| Organic matters (containing nitrogen ·26, equal to ammonia ·31) - - - | 5·85 |

The filtered clear water left, on evaporation, when dried at 300° Fah., 11·88 grains of solid residue, which on analysis produced—

| | | | |
|---|---|---|---|
| Organic matter - - - | 1·54 | or 12·4 | per cent. |
| Oxides of iron and alumina, with traces of phosphoric acid - - - - | 1·04 | or 8·4 | „ |
| Carbonate of lime - - - | 1·41 | or 11·3 | „ |
| Silicate of lime - - - | 3·87 | or 31·2 | „ |
| Sulphate of lime - - - | 1·32 | or 10·6 | „ |
| Chloride of sodium - - | ·79 | or 6·3 | „ |
| Carbonate of soda - - | ·48 | or 3·8 | „ |
| Nitrate of potash - - - | ·84 | or 6·8 | „ |
| Carbonate of magnesia - - | 1·15 | or 9·2 | „ |

In conclusion, I may be allowed to say that, though the question of warping is only one of importance locally speaking, yet, as a branch of the great subject of irrigation, it is one which cannot fail to be of interest to Surveyors; and if a result of this Paper, in which I have endeavoured, however feebly, to impart my own knowledge of the matter to others, is to lead any Members of this Institution to visit the warping districts of Nottinghamshire, Yorkshire, or Lincolnshire, and to see for themselves the process in actual operation, they will, I am sure, have occasion to thank me for having undertaken the task, however imperfectly I may have fulfilled it.

Mr. J. Martin (Member) rose with pleasure to propose a vote of thanks to Mr. Woolley for his interesting Paper. As the production of one of the younger Members of the Institution, it had been listened to with interest, and that interest had been justified by the merits of the Paper itself. He trusted that the example set by Mr. Woolley would be followed by others of his age and standing. He had himself

learned a good deal from the Paper on the subject of wet warping, the practice of which did not fall within the experience of many Surveyors.

Mr. R. B. Grantham (Associate of Council) begged to second the vote of thanks to Mr. Woolley, who had treated the subject of warping with great ability. His own experience, both of dry and wet warping—the former especially—was perhaps somewhat exceptional, and he would be glad, on a future occasion, to make a few remarks on the subject. In order that he and others who proposed to speak might have an opportunity of previously reading the Paper, he would move the adjournment of the discussion to the next Meeting.

Mr. R. C. Driver (Member) would be glad to know whether Mr. Woolley was acquainted with the system of dry warping practised in Cambridgeshire. This system consisted in taking out the clay sub-soil, and putting it upon the black surface soil, the result being a very great addition to the productiveness of the land. Possibly Mr. Bidwell (who, he observed, was present) would be able to give the Meeting some information on this practice, which was known as "claying."

He happened to know the Isle of Axholme. This district was, in the time of Henry II., a favourite refuge for lawless bodies of men, who for many years here set the king's forces at defiance. It was also the place of resort for many rebellious nobles in the reign of Henry III. It was not until the reign of Charles I. that any serious effort was made to reclaim this lawless and savage district, which was a series of small islands (mere swamps and streams), and thus wholly disconnected from the mainland. In this reign, as Mr. Woolley had said, the Government determined

to avail itself of the services of the Dutch adventurer, Cornelius Vermuyden, awarding him and his co-workers, who were called "participants," one-third of the land reclaimed, as reward for their enterprise. To this day the descendants or heirs of these original owners of one-third of the reclaimed land were known as "the participants."

Those acquainted with the Isle of Axholme were aware that it now comprised some of the finest soil in the east of England. He himself was old enough to remember some land in Lincolnshire, warped twenty-five years ago, which, before it was warped, was worth some 2*s.* 6*d.* or 5*s.* per acre, but now realized a rental of 50*s.* or 60*s.* per acre, proving that, in the neighbourhood of the Trent, the Ouse, the Don, and other large tidal rivers, warping was productive of most remunerative results. Considering how large a quantity of land was annually absorbed by railways, waterworks, and other public undertakings, and by the growth and increasing requirements of the population, it was highly important to utilize the waste lands of the country by methods, where applicable, such as those described in Mr. Woolley's interesting Paper, more especially such methods as were now being employed in Hatfield Chase. He thought that the Institution was much indebted to Mr. Woolley for his Paper.

Mr. C. Bidwell (Member) said that, in the fens of Cambridgeshire, the system technically known as "dry warping" was not practised, but a system somewhat analagous, known as "claying." In the fen districts of Cambridgeshire, warping from the rivers was impracticable, as the land lay so much below the level of the rivers that to run the water in would be to flood the whole country. Their endeavour was rather to get rid of the water. As Mr. Driver had said, their method of dry warping, or rather

"claying," was to dig out the subsoil clay from below the peat, and spread it over the surface of the land. This operation was performed at a very much smaller cost than that described by Mr. Woolley. Probably £6 an acre was now the maximum cost. Some years ago the cost did not exceed £3 10*s.* per acre, but the average was now about £4 10*s* or £5. The benefit lasted some eight or ten years. He remembered going over some land taken by the Doncaster and Gainsborough Railway, which was let at 5*s.* an acre, while on the other side of a hedge was land for which £3 10*s.* and £4 per acre was being paid, the difference being entirely due to improvements by warping.

The vote of thanks having been carried unanimously, the discussion was then adjourned to the next Meeting.

AT

## THE ORDINARY GENERAL MEETING,

*Held on Monday, January 14th*, 1878.

EDWARD RYDE (VICE-PRESIDENT) IN THE CHAIR.

The adjourned discussion on the Paper by Mr. T. C. Smith-Woolley, entitled "Warping," was resumed.

The following notes, by Mr. G. Cecil Smith, on the tract of reclaimed land in the estuary of the Humber, known as Sunk Island, were read to the Meeting :—

### Notes on Sunk Island.

The river or estuary of the Humber is formed by the junction of the rivers Trent and Ouse, ten miles eastwards of Goole (rivers which drain the east side of England from Grantham nearly to Darlington), and extends eastwards about thirty-five miles to the German Ocean at Spurn Point.

About eight miles from the sea, the river rapidly widened out from a breadth of three miles to eight miles, and Sunk Island has, within about two hundred years, been formed along the Yorkshire coast, at the north-west corner of this wider space. No record exists of the first appearance of dry land.

In the year 1660 the island consisted of about twelve acres, occupying a space not very far from the centre of the present island. About a hundred years afterwards it comprised 1,550 acres of cultivated land, divided into three

farms, with five houses occupied by farm-servants; and there was a small chapel. This portion is marked No. 2 on the plan.* Soon after the year 1800 the island was united to the mainland by the recovery of the area marked No. 3, comprising about 2,700 acres; and soon afterwards the frontages marked 4 and 5 were added, comprising about 300 acres. In the year 1826 a portion marked No. 6, comprising about 1,400 acres, was embanked, and in 1850 the easternmost portion, marked No. 7, was recovered; and the present total area of the island is about 6,600 acres, under cultivation.

In the year 1833 the estate was brought under the immediate control of the Crown, and in 1854 the whole was let on leases for twenty-one years.

There are fourteen leaseholds, comprising nearly 6,500 acres, and nine small tenancies, comprising more than 100 acres. Houses and farmsteads, in accordance with the character of the tenancies, were erected in 1854, the roads and communications were re-arranged and improved, the drainage was made more effective, the embankments were strengthened, and schools were erected. Recently the church has been restored at the cost of the Crown and of the lessees, and the parsonage house provided at the cost of the Crown.

The banks of this island comprise about 200 acres, and the length of the embankment, against the River Humber, from Stone Creek, on the west, to the Sunk Island Clough, on the east of the island, is about six and a-half miles. The accompanying plan delineates the several before-mentioned reclamations; and also the arrangement of the fourteen farms, and the portion occupied by the small tenants.

* This plan will be found after page 82.

The estate will bear comparison, in every respect, with any property of similar extent; whether as regards its church, parsonage, and schools, or its farms, homesteads, and cottages, and the cultivation of the farms; or the state of roads and fences; or the capital, skill, intelligence, and character of the lessees of the property.

This estate has not been recovered by warping, but by natural accretion. The River Humber brings up warp by every tide, and the spring tides bring more warp than the neap tides carry away, and therefore the upper parts of each bay of the river become filled up, until they cease to be overflowed, except by the highest spring tides. At a certain point of time, the land, only occasionally flooded, becomes covered with grass, and, where grass appears, the land may be embanked, and brought under cultivation.

In the case of warping, a previously existing bank is an actual fact, and the tide, being passed through a sluice made in the bank, is conducted over a level space (generally of sand), until a deposit of valuable warp, two or three feet deep, is obtained, and a considerable portion of the cost is occasioned by the building of the sluice. But, in the case of natural accretion, the principal cost is incurred in the formation of the bank itself—a cost varying from £14 to £20 an acre, under favourable circumstances.

The land taken in has necessarily a less depth of warp immediately behind the bank, and for this reason (chiefly) the enclosure of 1850 has proved less valuable than the older accretions. There is, at the present time, a considerable extent of land, eastward of this last bank, which is already covered with grass, and at no distant period may justify the expense of a further reclamation. But the values of natural accretions are very various.

It will have been observed in Mr. Woolley's admirable statement of the analysis of warp that he gives about

two-thirds of its material as sand. Warp is no doubt a mixture of sands, of various degrees of fineness, with clay, but the value depends upon the proper proportion of clay. Where warp is deposited the whole quantity of warp in suspension is nearly all thrown down at high tide when the water is quiescent, but the ebb tide, when the water is rough, sometimes washes away the whole of the clay. In exposed situations at Sunk Island the upper crust only of warp consists of clay, and the lower films consist almost entirely of sand. At four feet deep there is only sand. The warp deposited at Howden, on the Ouse, or at Crowle, on the Trent, where there is no disturbance, is of much superior quality; the layers being about one-eighth of an inch in thickness, and each layer containing the various mixtures of sand and clay in sub-layers.

There is, consequently, on the Ouse a depth of many feet of agricultural land of the highest quality, and this land produces a successful crop the year after it is reclaimed.

The problem is, how to obtain, on the exposed eastern coast of Sunk Island, the nearest approach to that successful result obtained in sheltered situations on the Ouse and the Trent, forty miles further from the sea. Those successful results depended wholly on securing a full proportion of clay. Without that full proportion of clay the land would be of little value when reclaimed. It has been suggested that the right course would be to embank a large extent of foreshore, leaving a sluice in the bank, and then to warp the land within the embankment in the manner so well described at the last Meeting, and that the sluice would undoubtedly afterwards serve as a drainage outlet; but the expense would be the cost of embanking with the addition of the cost of warping: say £40 an acre if any large extent were embanked.

Mr. W. Shelford (Visitor) said that it had fallen to his lot, as an engineer, to become acquainted with most of the marsh districts and flat lands on the east side of England; also with some on the south and west; and it was now just twenty-one years ago that he first went to the Fens to take charge of works of considerable magnitude, and thus became interested in the subject of warping and kindred questions.

At the last Meeting, Mr. Bidwell mentioned that there was no such process as "warping" practised in the Fens of Cambridgeshire, but that there was an analogous process known as "claying." That fact was worth noting, because the whole of the land in the part to which he referred lay considerably below the level of high-water in the rivers, which was the limit that the author of the Paper assigned to what he called "warpable" land.

He thought the reason for there being no warping in the Fen districts of Cambridgeshire might be explained by the fact that the low land was as rich, if not richer, than much of the high land; and the silt which the waters of the rivers contained consisting, to a very great extent, of sand, the land would probably be impoverished rather than enriched by warping.

In the Humber, and in the valleys of its tributaries, warping had been probably more extensively practised, and more successfully, than in any other part of England. The map* exhibited, which might be interesting to the Members, was a rough sketch, showing, approximately, the extent of reclaimed land below high-water, at ordinary spring tides, in the neighbourhood of the Humber. The Isle of Axholme, referred to by the author of the Paper, was represented by

* This map will be found after page 82.

the large circular spot, and, in the neighbourhood to which he more particularly alluded, there were something like 160 square miles of so-called "warpable" land. Lower down the river was the valley of Ancholme, and, between this valley and Sunk Island, there was a quantity of reclaimed land along the banks of the River Hull, and then Sunk Island itself, which consisted of land accumulated there by nature and improved by art. There was also a low fringe of land, on the Yorkshire coast, extending to Spurn Point, and on the Lincolnshire shore of the Humber there was another considerable tract of reclaimed land, which extended as far south as the level of the Fens.

The Humber was remarkable among the rivers of England for its enormous drainage area, which extended over 10,000 square miles (or one-fifth of the whole area of England), and for the extraordinary quantity of suspended matter which its waters contained, and which was of great value for agricultural purposes.

The author of the Paper put the question, "Whence comes this unfailing supply of warp?" and this question he would endeavour to answer. It had usually been held that the warp either came down from the upper districts traversed by the river, or was brought up by the tide from the sea, but the author of the Paper had started a new idea—that the warp came from the clay in the bed of the river. His own views on the River Humber would be found in a Paper which he read before the Institution of Civil Engineers, nine or ten years ago, on the "Outfall of the Humber." The plans and sections which accompanied that Paper showed that, although the channel of the Humber had been deepened, and was deepening at the present time, there was a considerable accumulation of silt warp on the

sides of the river, in its basin and outfall—an accumulation which, in fact, more than counterbalanced the scour. It was impossible, therefore, that the bed of the river could be the main source of supply for the warp, though it undoubtedly assisted.

As regarded the theory that the sea was the source of the warp, it was quite true that there was a great degradation of the coast in progress from Spurn Point to Flamborough Head, the encroachment amounting to something like 2¼ yards per annum, for a distance of 40 miles. He might mention, as illustrating the extent of this encroachment, that there was once, seaward of Spurn Point, a well-known place, "Ravenser" (mentioned twice by Shakespear, and remarkable in history, as having been the spot where Bolingbroke landed, and Baliol embarked his army for the invasion of Scotland), which had now entirely disappeared in the sea.

No doubt, when clay cliffs were washed down, a considerable part of the *débris* might be sucked into the estuaries, but, inasmuch as it came in at the top of the tide, it must, of necessity, go out also at the top of the tide; and could not, therefore, be a main source of supply. At Saltfleet, high-water mark had gone far from the port, and accumulations were going on at the present time. It was well known that the heavier portions of matter from the Yorkshire coast were deposited at the outfall of the Humber, and were travelling across it, and tending to shut it up; therefore, it was reasonable to suppose that the lighter particles would also find their way to, and be deposited more or less on, the Lincolnshire shore.

He saw no reason for ignoring the usual course of nature, and the operation of the law of gravitation, in obedience to which the particles of alluvial matter were washed down

from the higher districts of the river into the sea. To illustrate his meaning he would refer to tideless rivers, and would take the case of the Nile, the waters of which, according to the author of the Paper, contained, during flood, from 23 to 81 grains per gallon of suspended matter. Comparatively small as was this quantity of suspended matter, there was no question that the formation of a delta (now measuring 100 miles in width) in the Mediterranean was due to its presence in the waters of the river. The waters of the Danube contained, according to Sir Charles Hartley, 25 grains per gallon of suspended matter, and in this case a delta, 50 miles in width, had formed at the mouth of the river. He could, from his own observation, multiply instances, if it were necessary to do so.

The waters of the Humber contained a very much larger proportion of alluvial matter than either of the foregoing rivers, amounting, according to the analysis by Mr. Oldham, of Hull, to as much as 320 grains per gallon. He (Mr. Shelford) was inclined to account for the fact by assuming that the tidal water obstructed the discharge of alluvial matter—that, to put it simply, the travel of suspended matter towards the tidal outfall was very slow. In proof of this, he might mention that Mr. Bateman and Sir Joseph Bazalgette, in 1868, found that the suspended matter in the sewage of Glasgow travelled seaward at the low rate of five miles a fortnight; and Captain Calver had recently hit on exactly the same rate for the movement of sewage matter in the Thames. Compare this rate with that of tideless rivers like the Danube and the Nile, the flow of which is not less than 672 miles per fortnight (equal to two miles per hour) and it would at once be seen why, in the one case, enormous

deltas were formed, while, in rivers like the Humber, the same materials which in tideless rivers would have gone to form deltas were kept travelling up and down by the ebb and flow of the tide till they came to the triturated condition of the "warp" of the Humber, and the water held in suspension a larger quantity of them than was due to the normal discharge of the fresh water channels.

The exceptional quantity and character of the warp of the Humber, compared with other tidal rivers, was probably due to the form of its mouth and the protection afforded by Spurn Point.

Mr. R. B. Grantham (Associate of Council) wished to offer a few observations, but, in doing so, he should confine himself, as much as possible, to the geological and engineering features of the subject, and leave the agricultural consideration to those who understood it better than himself. He observed that the Paper dealt only with warping from rivers, as distinguished from sea warping, or sea embankments and reclamations, and the rivers selected were the Trent, Ouse (York), and Don, which possibly afforded the largest and best instances of the principle. These rivers had warped up the lands about Whitgift, Snaith, Swinefleet, Thorne, Crowle, and the River Derwent—a tributary of the Ouse,—and flowed down to an immense alluvial plain, which once formed part of the estuary of the Humber. These rivers took their rise in various geological formations, far away from the places of ultimate deposit, and traversed long distances in alluvial valleys before reaching the great central estuary.

The plains were surrounded by the new red sandstone, or Keuper marl and sandstone or Bunter sandstone, and upper and lower lias, and from the *débris* of these

formations was derived the matter held in suspension in the Humber, and technically known as warp. The analyses of various kinds of warp given by Mr. Woolley in his Paper were very interesting, in relation to the original sources of the material of which it was composed.

The amount of warp brought down by the rivers before enumerated was immense, and the quantity required to raise the 60,000 acres of reclaimed land, if only a foot in height, must be enormous. The amount of deposit from the rivers referred to by Mr. Woolley was, perhaps, exceptional. Few rivers in England carried so much material in suspension, and great advantage had been taken of the fact of its presence in the water. Many rivers contained none at all; others but little; while some, in which solid matter abounded, were so influenced by tides and currents that no deposition of the warp took place.

The quality and value of the deposit was very much influenced by the upland water, and its power—owing to its volume or its chemical constituents—of diluting or neutralizing the salt brought up by the tide. It might be remarked that flood waters in winter contained more matter in suspension than in summer; but in the latter season, owing to the diminished volume of the streams, a large amount of deposit took place on the banks.

There were many instances where the warping or inclosing of land from the sea was far from profitable in its immediate results; indeed, he had known cases where the land had not become available until six or seven years after being embanked. This, however, was frequently due to a want of proper cultivation, it being essential that the land, after being inclosed, should be well stirred and ploughed.

It might be asked, what became of all the warp that

was not deposited on the sides of rivers and upon shoals. The answer was, that the lighter particles were carried out to sea; while the heavier portions, when clear of the current, fell by gravitation to the bottom, and formed the bars and shoals at the harbours and river mouths.

Many rivers with which he was acquainted, in the south and west of England, formerly brought down large deposits, which had been embanked from the tide, and now formed some of the finest land in the kingdom, mostly pasture. He was not aware, however, that any of these lands were artificially warped up in the manner described in the Paper. They were all, he believed, formed by natural accretion, the embankment being pushed forward, bit by bit, as the areas outside the banks rose above the water level. As he had before observed, it frequently happened that a considerable time elapsed before the land reclaimed gave any return on the outlay. He knew lands, however—notably lands in the neighbourhood of the River Fergus, in Clare County, Ireland—which became productive at once. The Fergus was a tidal river, flowing over a large area of mountain limestone rock, the lime from which neutralized the salt so completely as to render the land at once suitable for producing crops.

Sluices draining large areas into a tideway ought, he thought, to be in the proportion of one square foot of opening to one square mile of area to be drained, at a given depth of water in the drain, and the sectional area necessary to retain the water, while the sluice was shut, should be capable of containing the rainfall upon the area. A certain length of the bottom of the drain above the sluice should be perfectly level, in proportion to its length, with such slopes of banks as the land would stand at.

He did not agree with the author, that in all cases

the tide should be free to flow in and out of the sluices, whether it had deposited the suspended matter or not. This must depend upon the amount of matter in suspension, for, in many instances, the proportion of such matter was very small indeed. The Yorkshire and Lincolnshire rivers, which were peculiarly rich in deposits, might perhaps be treated in the manner described by Mr. Woolley, but he doubted whether a larger deposit would not be secured in the same time by retaining the tides long enough to enable them to deposit their warp more thoroughly. Nearly all the tidal sluices with which he was acquainted had hand-sluices on the land side which could be shut to retain the water at pleasure, and it was a common practice to shut them and include water, particularly fresh water, for cattle, and to serve as fences.

He knew an estate on the Derwent, in Yorkshire, where scarcely any advantages whatever would have resulted from the warping, had the tide been free to come and go without restraint.

In many cases, the more distant parts of the land were so far from the sluice that there would not be time for the deposit to take place; therefore it was best to let the tides rest for a time, and turn them out when, by experience, it was found that a sufficient deposit had taken place. The quantity of water let in during neap and spring tides differed very considerably.

In Somersetshire, the river Severn contained a large quantity of matter in suspension, and the rivers Brue and Parrett also contained large quantities; but in these localities the deposit rested on the banks of the rivers, and fluctuated up and down according to the strength of the currents.

The largest tract of reclaimed land with which he had

been professionally concerned was situated on the east side of the Nene outfall, near Sutton Bridge, in Norfolk. The area there reclaimed (belonging to the Crown and to Guy's Hospital), since the formation of the Nene outfall, was something like 4,000 or 5,000 acres, all of which consisted of foreshore warped up and embanked from time to time, forming excellent land.

He had seen the process of dry warping in progress at Lindholme, on Hatfield Chase, referred to by Mr. Woolley and the Paper very accurately described it. When he (Mr. Grantham) saw it, only a very feeble attempt had been made to warp the Chase, but he had always been of opinion that, if vigorously set about, it would be as successful as it now promised to be. It differed from the dry warping of Delamere Forest, inasmuch as the latter was reclaimed on a sandy and gravelly soil, and the marl with which it was warped consisted of two kinds, and did not exceed half an inch in thickness. This marl acted chemically upon the soil, and consolidated it to some extent, and proved effectual in increasing its productiveness. The Lindholme marling was of quite a different character. There, the warp was taken from a once navigable river, and conveyed and spread on the moss by very much the same mechanical means as were employed at the Forest of Delamere.

As he had described in detail, (in an adjourned discussion on Papers read by Mr. Clutton and himself, which would be found in the 4th volume (page 83) of the "Transactions"), the marling of the reclaimed lands of Delamere Forest, he would not do more now than hand in, for publication, a concise tabulated statement which he had prepared, showing the quantity of land reclaimed at Delamere and the rate per acre at which the work was executed.

He might remark that Dr. Voelcker had analyzed

(for the Office of Woods) the warp used at Lindholme, as well as the two kinds of marl which were employed in the reclamation of Delamere Forest, and these analyses would be found in his own and in Mr. Woolley's Papers.

The Members would find a copy of the Report of the Lords' Committee on Rivers Conservancy, of last Session, in the Library of the Institution. This Report contained much information in a tabular form as to the state of the rivers of the kingdom, with their lengths and their water-shed areas.

The Reclamation and Marling of Delamere Forest.

| Name of Lands. | Acreage. | No. of Cube Yards. | Quantity per Acre. | Rate per Acre. |
|---|---|---|---|---|
| | Acres. | Cube Yards. | Cube Yds. | £ s. d. |
| Honslough . . | 248 | 29,000 | 130 | 7 4 11 |
| Longridge and Plover's Moss | 776 | 87,000 | 110 | 9 18 0 |
| Organsdale, Primrose Hill, &c., Allotments | 530 | 64,000 | 120 | 10 13 11 |

Mr. T. Smith-Woolley (Vice-President) said that, bearing in mind the lateness of the hour, he would confine his remarks within very narrow limits. With respect to the the Nene Outfall Reclamation Works, mentioned by Mr. Grantham, he had prepared plans showing the usual course which reclamation took on the sea shore of Lincolnshire and the estuary of the Wash. The plan exhibited * showed the state of the head of the estuary of the Wash at the beginning of this century. It would appear from it that the natural process of accretion was this :—Nature, left to herself, first covered the bare sands nearest the shore with warp, which, in the course of time, grew rough natural herbage, chiefly samphire. The warp slowly increased in height nearest the shore, until it was covered by high tides only, when grass gradually replaced the samphire. About the year 1830 (illustrating what Mr. Grantham had said as to the various qualities of reclaimed land) the embankment shown in the plan was made, carrying the Lynn road across the Wash, and inclosing about 1,400 acres at the head of the estuary. The "sands" shown on the plan to the southward of that bank still remained bare sand. The grass marsh was good land, but all the rest, more or less, low, weak, wet land, incapable of being effectually drained, and comparatively worthless. In 1847, a very large proportion of the "bare sands" to the northward of the bank last spoken of, having become covered with warp, was embanked, together with the adjacent "grass marshes" and "samphire marshes," to the extent of 2,170 acres, and was allotted among the various landowners interested. To show the value of the land thus acquired, he might mention that the Duke of Bedford bought of the Nene Outfall Commissioners, in 1850, 438 acres of the land so allotted for £28,320, the

* This plan will be found after page 82.

gross rental being £1,133, or about 52*s.* per acre. Four or five other inclosures had since taken place in extension of that last referred to, which was an exceptionally large inclosure. Usually, the true theory of inclosing was not to take in too much at once. By confining the inclosure to 500 acres, or thereabouts, it was done successfully, and, no doubt, in the course of years, the whole of the sands shown on the plan would be warped up.

It was a curious fact, however, that the warp seemed inclined to leave the Norfolk coast, and, by preference, attach itself to the Lincolnshire coast. The tracts coloured brown on the Ordnance map of the district (*exhibited*) represented the lands which had been accreted on both shores of the estuary since the Roman time. The old Roman bank being the landward boundary of the land so coloured, it appeared that about 30,300 acres had been accreted since the third or fourth century on the one side and only about 5,000 on the other. Time was so short that he would not pursue this subject further. He had had some experience in connection with the acquisition of land from the Humber; but he thought Mr. Smith's Paper on Sunk Island exhausted that subject. He must take exception to the calling marling or claying "dry warping," though they were, no doubt, to some extent kindred processes.

Mr. Grantham's very interesting account, in the *Royal Agricultural Society's Journal*, of the "Warping of Delamere Forest" was, no doubt, apposite to the discussion. As there had been sufficient time to enable the work to be tested, he should have been glad to hear whether it answered in the way of permanent improvement or not.

As his contribution towards information on the subject, he begged to put in a Paper relating to typical cases of chalking and marling in Lincolnshire and Yorkshire.

### East Ravendale, Lincolnshire.

*Land Chalked.—"Wold" Land.*

| Quantity applied. | Price per Cube Yd. | Cost. | Area of Land. | No. of Yds. per Acre. | Cost per Acre. |
|---|---|---|---|---|---|
| Cube Yds. | *d.* | £ *s.* *d.* | A. R. P. | Average. | Average. £ *s.* *d.* |
| 17,742 | 9 | 665 6 6 | 129 1 27 | 132¼ | 4 19 2 |

### Holme-on-Spalding Moor, Yorkshire.

*Land Marled.—Bar Farm, Hungry "Moor" Gravel.*

| Quantity applied. | Price per Cube Yd. | Cost. | Area of Land. | No. of Yds. per Acre. | Cost per Acre. |
|---|---|---|---|---|---|
| Cube Yds. | *d.* | £ *s.* *d.* | A. R. P. | Average. | Average. £ *s.* *d.* |
| 3,404 | 11½ | 163 9 4 | 18 2 23 | 184 | 8 16 9 |

### Tollingham Warren Farm.

*Chiefly Black and Grey Sand.*

| Quantity applied. | Price per Cube Yd. | Cost. | Cost of Land. | No. of Yds. per Acre. | Cost per Acre. |
|---|---|---|---|---|---|
| Cube Yds. | *s.* | £ *s.* *d.* | A. R. P. | Average. | Average. £ *s.* *d.* |
| 45,000 | 1 | 2,250 0 0 | 300 0 0 | 150 | 7 10 0 |

Note.—In the latter case the quantity of marl applied varied from 200 yards per acre on the worst land, to 100 on the less bad. That done on the worst land will last about 10 years, and it is intended then to put an additional 80 yards per acre upon it.

Mr. J. Martin (Member) said that there was one part of Mr. T. C. Smith-Woolley's Paper which struck him very forcibly — that part, namely, which described the process of dry warping from the old bed of the River Idle. According to Mr. Woolley, the covering of warp was laid on ten inches deep. The land was then at once sown with corn. If this were so, it was the first time he had ever heard of any land, dry-warped, clayed or marled, which would produce corn without some previous atmospheric exposure, or some admixture with other soils. It certainly appeared remarkable that ten inches of soil or deposit taken out of the bank or bed of an old river should at once produce corn. Perhaps Mr. Woolley would explain the matter a little more fully.

Had he anticipated the turn which the discussion had taken, he would have been prepared with some information on natural accretion. Mr. Smith, however, had given a very excellent description of what nature could do in certain districts. Sunk Island was one of the best instances of natural accretion in England. He had himself had some experience in embanking natural accretions in the neighbourhood of Boston. The area of the reclamation was something like 1,100 acres, and the operation had been one of the greatest successes of the kind ever achieved in Lincolnshire. Those 1,100 acres were inclosed at the rate of about £12 an acre, and the land was now worth from £70 to £80 an acre. Mr. Grantham had said that, in some instances of the kind, the land inclosed was practically unproductive for five or seven years; but the land he (Mr. Martin) had spoken of was inclosed one summer, and grew an extraordinarily good crop of corn the following year, viz., five or six quarters of wheat and nine or ten quarters of oats to an acre. This showed what land was equal to if not

inclosed too early. The great thing in inclosing from the sea was, not to take in too much land at once. Mr. Woolley had given 500 acres as about the right amount to inclose at once; but 500 acres, or even 400 acres, was considered an extreme quantity in Lincolnshire. Mr. T. Smith-Woolley, in speaking of the estuary of the Wash, had observed that the accretion was inclined to go to the north or north-west. This was, no doubt, correct as to the main body of the accretion; but it now began to attach itself to the east side of the Norfolk coast, and, no doubt, in two or three years' time some very good inclosures could be effected there.

He trusted that other young Members would be encouraged by Mr. Woolley's success to prepare Papers for the Institution.

Mr. T. C. Smith-Woolley was glad that his Paper had been the means of eliciting so good and interesting a discussion. In answer to Mr. Grantham, he might observe that the reason he had confined himself to the cases of the Trent, the Ouse, and the Don, was because, so far as he was aware, they were the only rivers which were used for the purposes of warping, though of course there were some tributaries of the Ouse which he might have mentioned. As regarded the area, he had only taken 60,000 acres as a very rough guess, and had no means of ascertaining the exact amount. He presumed that this was all that Mr. Shelford's calculation professed to be, as he observed that a long continuous area was shaded on the map, which he knew contained an immense number of acres of unimproved land, some of it incapable of improvement.

Another point which Mr. Grantham had raised, was as to the shutting in of the tide. He could only say that he

did not himself know of any instance in which it was found advisable to make provision for inclosing the tide, on the grounds which he (Mr. Woolley) mentioned in his Paper, namely, that it did not pay to lose the second tide, while the first was taking time to settle. Mr. Grantham mentioned that it might be found advisable to shut it in for irrigation, but he (Mr. Woolley) was only referring to irrigation by the tide for the purpose of warping.

With regard to Mr. Martin's question as to the immediate productiveness of land warped from the bed of the Idle, he was sorry he was unable to offer any explanation; he could only state it as a fact. As regarded the size of the area to be improved at one time, the 500 acres instanced by him were merely referred to as a particular case in point, not as a rule to be followed. It was very usual to warp in much smaller areas, and it was perhaps more advisable to do so. In conclusion, he begged to thank the Members for the kind way in which his Paper had been received.

The Chairman said that the author had favoured the Institution with a Paper which had led to a most interesting discussion. The practical advantages of warping had been demonstrated by the several speakers, and the question asked by Mr. Woolley in his Paper, "Whence comes this unfailing supply of warp?" had been fairly answered. The author challenged the prevailing theory that the warp was gathered by the river in its course from rich uplands, on the ground that "the deposit brought down by a land flood is always of an inferior quality to that brought up by the flowing tide." Mr. Woolley seemed equally disposed to question the theory that the warp was, to any considerable extent, derived from the degradation of the clay

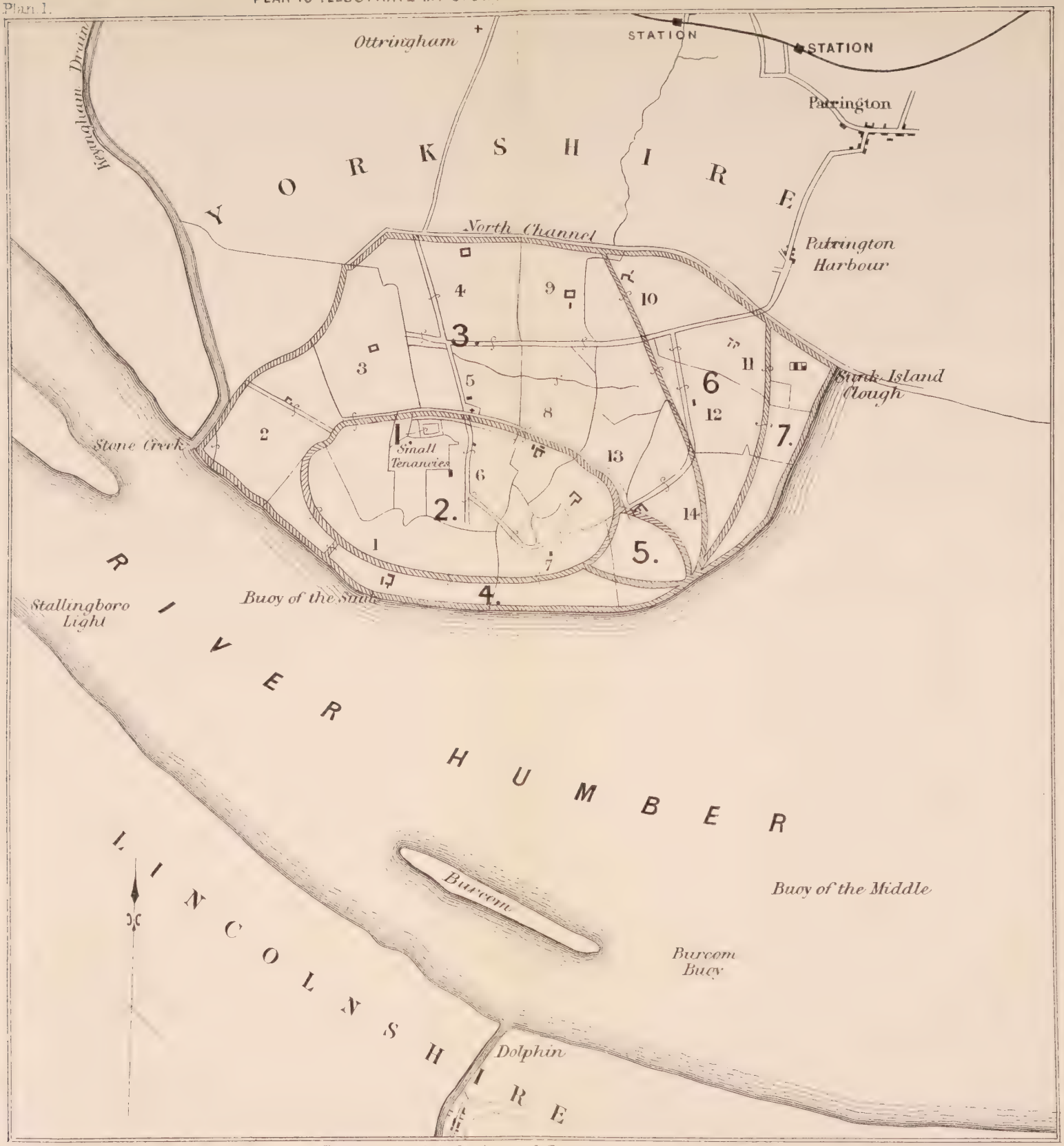
cliffs of Yorkshire, north of Spurn Head, and suggested that its presence in the Humber was due to the action of the tide on the soft clay underlying the Lincolnshire marshes, and of which the original bed of the estuary was doubtless composed. Mr. Shelford, on the contrary, upheld the general opinion that the presence of the warp was due to the land through which these rivers passed, and illustrated his argument very aptly by an allusion to the well-known deltas formed at the outfalls of tideless rivers like the Nile and the Danube. Mr. Shelford's views were confirmed by Mr. Grantham's observations. It was for the Members to judge which of these theories was best supported by the facts; but, without wishing to forestall that judgment, he was inclined to think that Mr. Woolley's question had been satisfactorily answered. A fact which could not fail to strike one was the apparently capricious manner in which these accumulations sometimes occurred :— why the warps should be piled up at Sunk Island, while between that place and Spurn Point comparatively little deposit took place, was very remarkable, though it could doubtless be explained by the action of currents. A question was asked in the Paper concerning accretions on other rivers. Accretions were taking place in the Thames, and other rivers, but they were small. It was worthy of remark that, when the City authorities were conservators of the Thames, all lands washed away were so much loss to the landowner, but all accretions were claimed by the City, and marked out with stones from time to time. He perfectly remembered that it was his duty, when a young man, to go round and survey the places where accretions had taken place, and set up boundary stones. There were many places in the Thames where this accretionary action was taking place, notably near the Oatlands Park Hotel, at Weybridge,

where, during the last few years, much land had been washed away. The accretion on the Thames formed capital osier beds. On his own property a similar accretion was taking place, and was beginning to rise above the ordinary water-level. It was possible that it might be worth while to assist the process in some way. In conclusion, he had great pleasure in thanking Mr. T. C. Smith-Woolley, on behalf of the Members, for the trouble he had taken in preparing his Paper, and could not forbear again expressing his opinion that upon the maintenance of the supply of practical Papers the future prosperity of the Institution in no small degree depended.

The Meeting then adjourned.

Plan 1.

# PLAN TO ILLUSTRATE MR G. CECIL SMITH'S NOTES ON SUNK ISLAND






Printed by C.F. Kell, London, E.C.

# TO ILLUSTRATE MR W. SHELFORD'S REMARKS ON WARPING

NOTE.

*The total Area of "Warpable" land on the Humber & tributaries is, approximately, 180, 000 Acres*

Printed by C. F. Weil, London, E. C.

# SUTTON WASH

## PLAN OF THE

MARSHES, BARE SANDS, CHANNEL & LANDS

Lying between

## KINDERLEY'S CUT AND THE SEA.

ABOUT THE YEAR 1800.

C F Weld Lith. 8 Castle St Holborn E.C.

No. 72.]

# THE LAW OF SUPPORT

IN ITS RELATION TO

# LAND, MINES, AND BUILDINGS.

By J. SMALMAN SMITH
(*Barrister-at-Law*).

*Read at the Ordinary General Meeting of the* Institution of Surveyors, *January 28th*, 1878.

THE PRESIDENT IN THE CHAIR.

## *General Scope of the Subject.*

Every man has a right to the ordinary enjoyment of his land in its natural condition, and a right to complain the moment that ordinary enjoyment is interfered with. This right to the ordinary enjoyment of property includes within itself all those rights which are termed natural rights, as distinct from acquired rights or easements.

The right of the owner to have the surface of his land supported by the soil of his neighbour, whether adjacent or subjacent, is one of these natural rights of property incidental to all land, but where the natural weight of the soil is increased by any artificial means, the rights of the parties become more complicated, and in some instances it is impossible to ascertain with exactitude the duties which the law casts on the owners of adjoining land. In treating this subject, therefore, we have to determine with reference thereto not only the natural rights of individuals to the enjoyment of property, but the circumstances under which

rights may be acquired, which, although they may be termed artificial, are none the less in some cases essential to the very existence of property.

### *As to Buildings.*

The rapid increase of building operations during recent years has given rise to corresponding difficulties in the way of ascertaining the rights of neighbouring proprietors. It becomes more than ever essential to determine under what circumstances the owner of a building can claim support either from the soil of his neighbour, or from the wall of his neighbour's house, and equally essential for that neighbour to be informed whether he is entitled to withdraw that support.

### *As to Mines.*

The rights of property in a large proportion of the land in this country are subdivided in a manner peculiar, so far as I have been able to ascertain, to England. The ownership of the surface and the ownership of the minerals are frequently vested in different persons, and the amount of support which the owner of the surface may claim from the owner of the minerals is a question upon the determination of which the usefulness and value of the property very considerably depends. In the mining districts the land is variously occupied. Dwelling-houses, manufactories, and railroads rest on the surface, whilst water is collected into ponds and reservoirs, or flows in well-worn channels in the soil, all of which are the subjects of rights of property or usufruct. The rights of property in the subjacent mineral strata are also of great value; nevertheless, the exercise of those rights, even in a careful and prudent manner, frequently causes injury to the surface by subsidence,

or otherwise by draining away the water from reservoirs and running streams.

We have now, therefore, to consider how to reconcile these conflicting interests, and determine the rights of the respective owners in these various descriptions of property. I will not dwell at any great length upon the important interests involved in this branch of the law. Examples will readily present themselves to the minds of those whom I am now addressing, and your practical experience will supply any deficiency in the illustration of the abstract principles of law which lie within the narrow limits of the Paper I have the honour to read before you to-night. I will therefore content myself with laying before you a concise summary of the law of support.

## The Laws of Foreign Nations.

I desire first to direct your attention to a brief survey of the subject, as treated in the codes of other nations, in the hope that by so doing I may the more clearly point out the peculiarities and inconsistencies in the English law which render it so difficult of enunciation.

### *Support to Land.*

I have been unable to find any mention of the servitude of support for land, either subjacent or adjacent, in the writings of the Jurists, or in the codes of any European nations. It is true that there are minute regulations which serve to guard the natural rights of property from interference, but these relate to certain precautions which are strictly enjoined upon neighbouring owners, and are in no way connected with servitudes which receive, as will be pointed out, separate attention and precise definition.

### *Roman Civil Law.*

If we take as an example the Roman Civil Law, upon the model of which most of the European codes have been framed, we shall find the rule thus stated (*a*) * :—"If a man place a hedge near to his neighbour's property and dig into the earth, he must not overstep his boundary. If he build a wall, he shall leave a foot; but if a house, two feet. If he dig a sepulchre or a ditch, he shall leave a space (between it and his neighbour's land) equal to the depth of the sepulchre or ditch. If he dig a well, he shall leave a space of five feet."

### *French Law.*

In the Code Napoleon, where these provisions are slightly modified to suit the requirements of modern times, the article is as follows:—"Whoever digs a well or a ditch near a wall, whether party wall or otherwise, whoever wishes to build against such wall a chimney, forge, or oven, to erect a stable against it, or establish a magazine of salt or any corrosive materials, must leave the interval prescribed by law and custom in this respect, or construct the works prescribed by law to prevent injury to his neighbour" (*b*).

### *Austro-Hungary, Holland, and Italy.*

More elaborate, but similar provisions are to be found in the laws of Austro-Hungary, Holland, and Italy, but throughout the whole no mention will be found of any easement of support for land (*d*).

### *Spanish Law.*

In the laws of Spain, where, from the great mineral wealth of the country, it would be natural to suppose that

* The letters in brackets refer to the list of "authorities cited" at the end of the Paper.

some such conflict of interests as exists in England, would have called for and obtained express legislation, no allusion is made to the servitude of support for land. Mines in Spain belong to the Royal patrimony, permission being granted to discoverers to work the mines, upon payment to the Crown of certain duties and a proportion of the profits. In England, no such theory exists, except with regard to mines of gold and silver, the owner being entitled, by virtue of a supposed original grant from the Crown, to the property in the soil, upwards to the heavens, and downwards to the centre of the earth.

The Spanish law, while conceding certain privileges and rewards (mercedes) to discoverers, orders that *care should be taken not to injure the estates of individuals,* which would seem to imply a right to compensation in the event of injury to the surface of land, but such a right is nowhere more expressly defined (*c*).

### *Support for Buildings.*

There are, however, certain rights of support for buildings which have been generally recognized in the laws of European nations, and which are, for the most part, identical with those mentioned in the Roman Civil Law. The strict servitudes of houses in the Roman Law were *oneris ferendi* and *tigni immitendi,* both of which may be called servitudes of support. The first was the right one had of resting the weight of his house upon his neighbour's wall or pillar, so that it nearly resembled that of *tigni immitendi*, by which one was obliged to receive into his wall a beam or joist from his neighbour's house. The general nature of both were the same. The essential difference between them, lay in the precise form of words that the Romans used in constituting the servitude, *oneris ferendi : "Paries oneri ferundo, uti nunc est, ita sit,"* by which express words, the owner of

the servient tenement became obliged not only to suffer the weight of the neighbouring house to rest on his wall, but to repair that wall when it became unable to support the load contrary to the general nature of servitudes, which laid the proprietors of the servient tenement under no obligation to do any positive act, but barely to suffer it. Yet, he who owed the servitude had an option to abandon his property, if he did not choose to uphold it in a condition fitted for the use of the dominant tenement (*a*). It will be sufficient to give one example of the application of these principles in modern times. It is laid down in the Civil Code of Austro-Hungary, § 487. Whoever has to bear the weight of the neighbouring building, the insertion of the beam of another in his wall, or suffer the smoke of another to pass through his chimney, must contribute proportionately to the preservation of the wall, pillar, partition, or chimney, destined for the purpose, but one cannot demand that he should support the estate in favour of which the easement is constituted, or repair his neighbour's chimney (*d*).

We now proceed to consider the origin of the law of support as it exists in this country.

## The Right of Support in English Law.

### *Origin of the Law.*

With regard to the lateral support for land when the adjoining closes belong respectively to different individuals from the surface to centre of the earth, the law of England has long settled the degree of lateral support which each may claim from the other.

Sir Henry Rolle, who was the co-temporary of Littleton and Selden, in his "Abridgment," published 1668, by Sir Matthew Hale, states the simple proposition as follows:—(*e*).

"If A. be seised in fee of land adjoining the land of B., and A. erect a new house on his land, and any part of the house is erected on the confines of his land next adjoining the land of B.; if B. afterwards digs his land so near to the foundation of the house of A., but no part of the land of A., by which the foundation of the house and the house itself falls into the pit, yet no action lies by A. against B., inasmuch as it was the fault of A. himself that he built his house so near to the land of B.; for he by his own act cannot prevent B. from making the best use of his land that he can.—But *semble*, a man who has land near adjoining to my land cannot dig his land so near my land that thereby my land shall go into his pit. And, therefore, if an action be brought for that it will lie."

The principle of law here laid down as in force upwards of 200 years ago has continued to prevail up to the present day, and is still generally acknowledged; but the law which determines the relative rights and duties of the owner of the surface and the owner of the minerals is of comparatively recent growth, and owes its origin to the development of the mineral wealth of this country, which has assumed such great proportions during the present century. The law, indeed, cannot be said to have been settled until the decision of the House of Lords in *Humphries* v. *Brogden* in the year 1850, when Lord Campbell stated that "Where portions of the freehold, lying one over the other perpendicularly, belonged to different individuals and constituted as it were separate closes, the degree of support to which the upper is entitled from the lower had as yet by no means been distinctly defined." (*f*) The law therefore relating to subjacent support will be mainly comprehended in the decisions of the courts, and in the *dicta* of the judges, during a period of less than thirty years.

We will now examine more closely the peculiar characteristics of the right to support in the English Law.

### *Nature of the Right.*

It has already been remarked that the right of support for land in its natural state is a natural right, *ex jure naturæ*, and not what is known as a servitude or easement, for, although the existence of such a right places a restraint on what a man may do with his own, still, as we are very frequently told, it is in accordance with the well-known precept, *sic utere tuo, ut non alienum lædas.*

No one would venture to doubt the soundness of this admirable maxim, but there is considerable difficulty in its application. Many instances will suggest themselves to your minds, in which the law gives its sanction to acts on the part of a landowner directly calculated to injure the property of a neighbour, but which, although justifiable as within strict legal rights, are seldom resorted to by individuals in order to enforce those rights.

Mr. Justice Erle stated the practical result of this maxim as follows:—"A party may damage the property of another where the law permits, and he may not where the law prohibits, so that the maxim can never be applied until the law is ascertained, and, when it is, the maxim is superfluous."

Where a man is thus restrained from the full use of his property, or is obliged to suffer another to do certain acts upon it, which otherwise would be competent solely to the owner, his property may, in some sense, be supposed to be damaged, or rather burdened.

### *An Easement defined.*

The burden thus imposed is termed a servitude or easement, and he whose property is subject to a servitude is not

ordinarily bound to perform any act for the benefit of the person or tenement to which it is due. His whole burden consists in being restrained from doing, or in being obliged to suffer something to be done upon his property by another. In the former case, the servitude is negative, in the latter, positive.

The easement of support, where it may properly be so termed, is a negative easement, by the operation of which the owner of the burdened or servient tenement is restrained from withdrawing the support which his land or building affords to the dominant tenement.

It may here be stated that the right to light is another and a familiar example of a negative easement, and is merely a right to prevent the obstruction of the light. Lord Campbell once compared the right of support to a right of light (*f*); but this latter right, as was pointed out by Chief Baron Pollock (*g*), is created by the express enactment of the third section of the Prescription Act.

It is now proposed to enquire how the right of support may be acquired, and what circumstances have been held sufficient in law to establish the easement.

### *The manner in which the right may be acquired.*

It was for some time a matter of doubt whether such rights came within the operation of the Prescription Act (2 & 3 Will. IV., c. 71); but it seems to be now generally admitted that rights of this sort, if they can be established at all, must have their origin in grant.

There exists, unfortunately, even at the present time a great difference of opinion amongst the judges on the true construction of the second section of the Statute, which requires that the easement should have been enjoyed for twenty years *under a claim of right.* Now, in the great majority of cases,

neither party is acquainted with the existence of the easement. The owner of the building which seeks support cannot tell whether such support is or is not actually accorded, whilst the owner of the servient tenement, whether he knows it or not, has not the means of resisting. How then can such a claim be of right? (*h*).

But it may be suggested, if it is competent to a man to prevent the acquisition of a right to light by obstructing it, why not adopt a similar means to prevent the acquisition of the easement of support, and excavate the soil so as to let down the neighbouring house? It is clear that such an act would be justifiable in law, and should the parties fail in coming to any arrangement there seems to be no other remedy provided by law which would enable the owner of the property sought to be dominated to resist the acquisition of a claim, if not of an easement, of support. But even this is a perilous alternative to the party seeking to resist the acquisition of a right to support, for in order to justify the letting down of his neighbour's house he will be called upon to prove that the weight of the house caused the falling in of the land, and that the support he had withdrawn by his excavation was not necessary to his neighbour's land, supposing that land to be unencumbered by buildings and in its natural state. Should he fail to establish this fact to the satisfaction of the jury, he will be liable in damages for the injury to the building. But in such a case, even though the building had stood for twenty years, no prescriptive right would have been established; the damages would be based on the disturbance of the natural right of support to the land and the consequent injury to the building.

Reverting to the question of prescription, the cases are conflicting; but the great weight of authority is strongly opposed to the theory which would allow the acquisition of

negative easements by prescription, excepting, of course, the easement of light.

In a recent case of *Angus* v. *Dalton* (*i*), the Lord Chief Justice expressed a strong opinion to the effect that the right of support could not be considered an easement within the operation of that "strange and perplexing statute," the Prescription Act. Before the passing of that Act no presumption in favour of a right was raised until twenty years' enjoyment after the parties were aware of the fact. It was the object of that Act to get rid of fictitious presumptions, but the Act does not take away the right which existed before the passing of the Prescription Act of the party resisting the claim to rebut the presumption raised by user.

It is to be regretted that Mr. Justice Lush was unable to agree with the opinion expressed by the Lord Chief Justice. In the view of the learned Judge "the mere absence of actual assent, or even the fact of actual dissent, would not be sufficient to rebut the presumption arising from twenty years' actual user and possession. Moreover, the Prescription Act converted twenty years' actual possession into a right, and it would be a strange anomaly if twenty years' enjoyment would be sufficient to give a right to the house, but not to give a right to the support of the house. The mere fact of assent never having been given was not, therefore, sufficient to prevent the plaintiffs from acquiring the right which would support the action." I have alluded to this case as showing that there is by no means a *consensus* of opinion among the Judges upon this question. The view taken by the learned Judge whose opinion I have just cited would seem to give more weight to what may be termed "adverse user and possession" than has been hitherto allowed by the Courts. As the result, however, of the more recent authorities (although the question can hardly be regarded as settled), it may be stated that, excepting the

easement of light, a presumption arising from user is capable of being rebutted by evidence of the circumstances attending such user, more especially when, from the nature and character of the easement claimed, the party is incapable of resisting its enjoyment.

### *Unity of Title.*

Under certain circumstances, therefore, the Court will direct a jury to presume a grant of a right to support. It would do so, for example, when the adjoining properties were originally in possession of the same owner, for "a man may not derogate from his own grant." In *Peyton* v. *Lord Mayor of London* (*k*), Lord TENTERDEN intimated that, if it appeared that both houses were originally built at or about the same time, and by the same owner, the right to support might exist. And in the case of *Richards* v. *Rose* (*l*), Chief Baron POLLOCK remarked, "We are all of opinion that where houses have been erected in common by the same owner upon a plot of ground, therefore necessarily requiring mutual support, there is either, by a presumed grant, or by a presumed reservation, a right to such mutual support, so that the owner who sells one of the houses as against himself grants such right, and on his own part also reserves the right, and consequently the same mutual dependance of one house upon its neighbour still remains."

### *"Other circumstances" from which a Grant will be Presumed.*

But where there is no evidence of such unity of title, there are "other circumstances" from which a grant of a right to support may be presumed. It is extremely difficult to say what those circumstances are. The general tendency of the authorities is to the effect that where there is evidence of the circumstances under which the building was erected,

and where that evidence negatives the presumption of a grant of a right to support, the mere fact of user will not be sufficient of itself to establish the easement. The danger of entertaining the opposite doctrine, which would give full effect to mere user and possession, whether "adverse" or otherwise, is thus forcibly stated by Chief Baron Pollock in the case of *Solomon* v. *The Vintners' Company* (*g*). "It does seem contrary to justice and reason that a man, by building a weak house adjoining his neighbour's, can, if that weak house gets at all out of the perpendicular, and leans upon the adjoining house, thereby compel his neighbour either to pull down his own house within twenty years, so as to prevent a right from being acquired by twenty years' enjoyment, or to bring some action at law the precise nature of which is not very clear, or to otherwise acquire an adverse right against him."

This is the difficulty which will occur to every one as the inevitable result of admitting the operation of prescription upon the right to support. Under certain circumstances, however, a grant may be presumed when support has been enjoyed "time out of mind," (*m*) and where there is no evidence to show the time when the building for which support is claimed was erected, nor any evidence of unity of title. So much for the manner in which a right of support may be acquired, and we may pass on to consider the character of the right itself in its relation to various descriptions of property.

The right to support is of a threefold character. 1st. It exists with regard to land in its natural state, unencumbered by buildings; 2nd, with respect to land subjected to any artificial pressure, such as buildings; 3rd, and lastly, a right to support may be claimed for one building from another adjoining building.

## Right of Support to Land.

### *Lateral Support.*

The natural right of support for the surface of land from the soil of a neighbouring owner is a right which extends to lateral support as well as to support from the subjacent strata. With regard to the right to lateral support from adjoining land, this is not to be supposed to be gained upon the presumption of a grant, but is a right of property passing with the soil. The law on this point was thus stated by Sir George Jessel:—"As I understand, the law was settled by the House of Lords confirming the decision of the Court of Exchequer Chamber in the case of *Bonomi* v. *Backhouse* (*o*), that every landholder in the kingdom has a right to the support of his land in its natural state. It is not an easement, it is a right of property" (*n*).

### *Subjacent Support.*

And in like manner, with regard to the right of subjacent support, Lord Campbell, in *Bonomi* v. *Backhouse* (the case cited by the Master of the Rolls), expressed an opinion "that the right of support from the subjacent strata was a natural right of property to be presumed till evidence is given to rebut the presumption, and that such a right was not to be considered an easement or servitude arising from a grant." If, therefore, the owner of two adjoining plots of land conveys away one of them, the purchaser, without any grant, or the presumption of any grant for that purpose, is entitled to lateral and underground support, the very instant such conveyance is executed, as much as after the expiration of twenty years, or any longer period. The right of subjacent support where there are separate freeholds from the surface, and where the surface and the minerals belong to different

owners, has been compared (*f*) to the separation of a house into different floors or storeys, each storey belonging to a different owner in the manner commonly found in Edinburgh, in which case the proprietor of the ground floor is bound, merely by the nature and condition of his property without any servitude, not only to bear the weight of the upper storey, but to repair his own property, that it may be capable of bearing that weight.

It is important at the outset that the consideration of this question should be freed from the idea that the right of support for land in its natural state is in the nature of an acquired right or easement. The right being incident to all property in land imposes duties on the adjoining owner by which he is restrained from doing any act which would interfere with the ordinary enjoyment of his neighbour's property. A man may not, therefore, excavate his land close to his neighbour's boundary without leaving sufficient support for his neighbour's soil; neither must he so conduct mining operations as to cause the surface of his neighbour's land to subside.

### *Definition of "Adjacency."*

It sometimes happens that the injury complained of has not resulted directly from the act of the next adjoining owner, but by the act of one more remotely situated. Before proceeding, therefore, to consider the duties of neighbouring owners, it is necessary to ascertain what the words "adjacency" and "neighbourhood" mean in these cases. These words have received an interpretation in a recent case (*n*) before the Master of the Rolls, which has been generally accepted by the Courts. Sir GEORGE JESSEL, there says, that "that is the adjacent land, and that is the neighbouring property, which in extent would, *in the natural state of things,* afford the requisite support to the

dominant tenement. The land might be of so solid a character, consisting of solid stone, that a foot of it would be enough to support the land. There might be other land so friable, and of such an unstable character, that you would want a quarter of a mile of it."

The extent therefore of the land which affords support will vary according to the nature of the strata, and may possibly include the property of several owners; and the question, what is adjacent land? will not depend merely upon boundaries, but will include the land next adjoining, necessary for the support of the soil irrespective of ownership, whatever may be the character of the soil or the nature of the subjacent strata.

### *Custom of Mining.*

Neither does the custom of mining in a district in any way affect the right of an owner to support for the surface of his land, and that right is not a right to any particular means of support, such as pillars or props. His right is a right to the ordinary enjoyment of his land, and, till that ordinary enjoyment is interfered with, he has nothing of which to complain (*o*); he cannot therefore complain if the mining owner should withdraw the natural support, and substitute artificial supports, such as props or pillars, provided no injury is caused to the surface by so doing. But in the absence of express contract, if mining operations cause injury to the surface, although those operations may not have been conducted negligently, nor contrary to the custom of the country, the owner of the surface may maintain an action against the owner of the minerals for the damage sustained by the subsidence.

The case of *Humphries* v. *Brogden* (*f*) was an action, by the occupier of the surface of land, for negligently and improperly, and without leaving any sufficient pillars and

supports, and contrary to the custom of mining in the country where the mines were situated, working certain coal mines under and contiguous to the said land, so that by reason thereof the surface gave way. The plaintiff was in occupation of the surface, and the defendant of the subjacent minerals. The surface in this case was not built upon. The jury found that the defendant had worked the mines carefully according to custom, but without leaving sufficient support for the surface. It was held that the plaintiff was, on this finding, entitled to have the verdict entered for him, for the reason that, of common right, the owner of the surface is entitled to support from the subjacent strata, and, if the owner of the minerals removes them, it is his duty to leave sufficient support for the surface in its natural state. Lord CAMPBELL, in the course of his judgment, said :—"We have therefore to consider whether, when the surface of land (by which is here meant the soil lying over the minerals) belongs to one man, and the minerals belong to another, no evidence of title appearing to regulate or qualify their rights of enjoyment, the owner of the minerals may remove them without leaving sufficient support to maintain the surface in its natural state. This case is entirely relieved from the consideration how far the rights and liabilities of the owners of adjoining tenements are affected by the erection of buildings; for the plaintiff claims no greater degree of support for his lands than they must have required and enjoyed since the globe subsisted in its present form."

*Nature of the Mineral Strata.*

The degree of support to which the surface owner is entitled is not affected, as I have already stated, by the nature of the subjacent mineral strata. In the case of *Wakefield* v. *The Duke of Buccleuch* (*p*) the evidence as

to the nature of the mines was as follows:—That they were of hæmatite or red ore; that the veins varied very much in the thickness, some being not more than two or three feet thick, others as much as forty or fifty yards, and that the same vein would often vary very much between those figures. That the ore in some cases rose to within a few feet of the surface, and in other cases was not found until after passing through from twenty to forty yards of superincumbent *débris*, consisting of gravel, clay, sand, boulder stones, and other loose materials; that these, upon approaching the top of the vein, were more or less mixed with ore, and that there was no exact parting between the loose *débris* overlying the ore and the ore itself; that the rocks forming the walls of the veins were very much mixed with ore, and that strings or pipes of the ore ran several yards into the rock, making it rotten and unstratified. On the question of the method of working the mines the evidence was very conflicting. The Court, however, considered that the result was that the mines could not be effectually worked without causing a subsidence of the surface. It was held that the lord of the manor has no right to work mines so as to destroy the surface when the property in such surface is in another person, and that it being therefore impossible to work the mines without creating a subsidence of the surface, a perpetual injunction was granted. When, therefore, from any cause the rights of the surface owner and the owner of the minerals cannot co-exist, the question arises which must give way? Mines must be regarded as a tenement subservient to the surface; and, upon the principle laid down in *Humphries* v. *Brogden*, "The surface in its natural state, and unencumbered by buildings, is entitled to support from the minerals, whatever may be the nature of the mineral strata."

*Extent of the Land from which Support may be claimed.*

It may here be noticed that this right of the surface owner exists not only in respect to the minerals immediately under his own land, but extends also to the subjacent strata of the adjoining land. The surface owner has no right to complain, however, until some injury actually occurs, and mining operations in the adjoining land may not be the immediate cause of the subsidence of the surface, which may possibly result from mining operations in land not adjoining the injured property, but more remotely situated. Now the term "adjacent" land has already been explained to mean the land which in the *natural state of things* would have afforded the requisite support. But when the adjacent land is not in its natural condition, but has been mined or excavated, it becomes important to ascertain how far the rights of the parties are affected by such a state of facts.

In the case of the *Corporation of Birmingham* v. *Allen* (*n*), which came before the Court of Appeal in August, 1877, it was held that a landowner not immediately adjoining could not be held responsible for the subsidence caused by mining in his own land if the land next adjoining the injured property had been so excavated and disturbed as to be unable to give a proper amount of support to the neighbouring property, and, further, that the support to which the landholder is entitled from the adjacent land is confined to such an extent of adjacent land as, in its *natural and undisturbed state*, was sufficient to afford the requisite support. The facts in that case were these:—Between the land of the plaintiff and that of the defendants, who were owners of a colliery, there was an intermediate piece of land, the coal under which had been worked out some years before by a third party. The effect of the cavity in the intermediate land was, that, when the defendants worked the coal under

their land, subsidence was caused in the surface of the plaintiffs' land. It was admitted that, if the intermediate land had been in its natural state, no injury would have been caused to the plaintiff by the defendants' working. The case was tried in March, 1877, before the Master of the Rolls, who held that the plaintiff had no right of action against the defendants. This decision was affirmed on appeal, and Lord Justice JAMES, in giving judgment, remarked :—"I agree with the Master of the Rolls, that it seems a very startling proposition to say that a man who has got a property in valuable mines can be deprived of those valuable mines, because some one else between him and somebody else, a third person, has been doing something with his property."

But, on the other hand, where land has been excavated and disturbed by mining or otherwise, and its natural condition so altered as to make it demand more support from the neighbouring soil, the owner of the excavated land has no right to the additional support so required. Although it would seem that an easement may be claimed for the support of the excavated land after the lapse of twenty years from the commencement of operations. This proposition, however, merely depends upon general principles, and is unsupported by express authority.

*Result of the Authorities on subjacent Support.*

We may safely conclude, however, that the law is settled to this extent, and, as the result of the authorities referred to, it may be assumed that the owner of the surface, while unencumbered by buildings, and in its natural state, is entitled to have it supported by the adjacent land, and by the subjacent mineral strata, irrespective of ownership, without reference to the nature of the strata and the difficulty of propping up the surface, or the comparative value of the

surface and the minerals, and it follows that the only reasonable support is that which will protect the surface from subsidence, and keep it securely at its ancient and natural level.

### *Effect of Custom.*

Custom and usage have been frequently urged in order to defeat the operation of the natural right to support, but usage being only evidence of what is reasonable, no custom could be considered valid which operated to deprive the owner of the surface of ordinary use and enjoyment of his property (*q*), and, therefore, a custom for the owner of the surface so to mine as to let down the surface, to the damage of the buildings, has been held to be repugnant and absurd, and wholly void (*p*). Where mines are worked carefully, and according to the custom of the country, the owner of the minerals is, nevertheless, liable for the injury to the surface.

### *A Custom of the Manor.*

A custom within the manor, for the lord who is seised in fee of the mines and collieries therein, to work them under any dwelling-houses, buildings, and land parcel of the manor, doing no unnecessary damage, and paying to the tenants and occupiers of the surface of lands damaged thereby a reasonable compensation for the use of the surface of the lands, *but without making any compensation for any damage occasioned to any dwelling-houses or other buildings* within or parcel of the manor, by or for the purpose of working the said mines and collieries, has been held to be void, as being unreasonable (*r*). But there may be a perfectly legal custom, that the lord of the manor may get all minerals under the copyhold lands, *paying compensation* to a copyhold tenant for any damage he may do in respect of the surface, in getting them (*s*).

### *Inclosure Acts.*

Where waste lands have been inclosed under Inclosure Acts, either general or local, no custom is considered valid by which the lord might gradually take away the rights of the commoners. The lord, therefore, has no right to work his mines so as, either actually or virtually, to destroy the common by letting down the surface, and thus render it inaccessible to the cattle of the commoners.

### *Acts of Parliament.*

In all cases, however, where the question arises under an Act of Parliament, the rights of the parties are determined by reference to the provisions of that Act. And there is no doubt that a right to excavate, so as to withdraw the support from the surface, may be acquired under an Act of Parliament, if such appears to be the intention of the legislature (*s*).

### *Railway Companies.*

Another important exception from the law entitling a surface owner to support is to be found in the case of railway companies who purchase land under the peculiar provisions of "The Lands and Railway Clauses Consolidation Acts, 1845." It is sufficient here to mention that companies are by statute placed on a totally different footing from ordinary purchasers, and do not acquire that right to support for the surface of land, from the subjacent minerals to which ordinary purchasers become entitled by implied grant, or of natural right (*t*).

## Rights of Support when the Minerals are Granted or Reserved by Deed.

The right to deprive land of support may, however, be granted by deed, and, upon the severance of the surface and the minerals, a deed may be framed empowering the owner of the minerals to remove the whole of them without leaving support for the surface. In all these cases the contract would regulate the obligations and the rights of the parties; but, when the contract is ambiguous, there is a presumption of law that the surface is not to be interfered with, and that would turn the scale in favour of the grantee of the surface (*u*). It appears that, although the tendency of the authorities in times past went certainly to the extent of supposing it to be unlawful to contract that the surface might be let down, yet the modern authorities, when carefully examined, are all one way, and will be found to make the question depend on the construction of the deeds (*s*). And in determining the true construction of the contract, if you find that the exact sort of damage was contemplated by the parties, and that compensation was agreed to be given for it, you must imply the right to do the thing, the power of doing which must have been contemplated in order to cause the damage to be contemplated (*v*).

On this point Lord Wensleydale in his judgment in *Rowbotham* v. *Wilson*, remarks (*w*) :—"There is no doubt that, *primâ facie*, the owner of the surface is entitled to the surface itself, and all below it, *ex jure naturæ*, and those who claim the property in the minerals below, or any interest in them, must do so by some grant from or conveyance by him, or it may be from the Crown, as suggested by Lord Campbell in *Humphries* v. *Brogden*. The rights of the grantee to the minerals, by whomsoever granted, must depend upon the terms of the deed by which they are conveyed or reserved.

When the surface is conveyed it must, *primâ facie*, be presumed that the minerals are to be enjoyed, and therefore that a power to get them must also be granted or reserved as a necessary incident. It is one of the cases put by Sheppard (Touchstone 5 c. p. 89), in illustration of the maxim *Quando aliquid conceditur, conceditur etiam et id sine quo res ipsa non esse potuit*, that by the grant of mines is granted the power to dig them. A similar presumption, *primâ facie*, arises that the owner of mines is not to injure the owner of the soil above by getting them if it can be avoided. But it rarely happens that these mutual rights are not precisely ascertained and settled by the deed by which the right to the mines is acquired, and then the only question would be as to the construction of that deed, which might vary in each case."

A similar point was raised in the recent case of *Aspden* v. *Seddon* (*s*). The grantor there in effect said: "I reserve to myself, my heirs, appointees, and assigns the right of taking the minerals which are supporting your house, I and they paying all compensation."

*General Rule for the Construction of Grant or Reservation.*

The general principle which seems to follow from this case, and from the more recent authorities, is that, where in a mining lease full powers are granted to get the minerals and take them away, but no provision is made for compensation in the event of injury resulting to the surface, *such powers standing alone* would be consistent with the construction that the mineral owner may take away every part of the minerals provided he can do so without violating the surface-owner's right to support, but not otherwise. If, however, express provision be made for compensation, owing to the subsidence of the surface, the owner of the minerals will not be restrained from getting the minerals, but the owner

of the surface is left to his remedy at law to recover compensation for the injury caused, not by wrongful acts, but by rightful acts. In each case, however, the rights and duties of the parties are determined by reference to the particular grant or reservation, and where the terms of the grant or reservation are sufficient to show that the injury to the surface was contemplated, and that it was intended that the grantee or the lessee of the minerals should have the right to work the mines, so as to let down the surface, and where compensation for the injury so caused was expressly stipulated for on the part of the owner of the surface, the Court will give effect to the contract between the parties; and, having arrived at that conclusion from the construction of the instrument, "the Court is not compelled by any rule or presumption of law to say that the parties may not so contract" (*s*).

### *Support from Water Underground.*

It sometimes happens that underground water affords support to land, and it becomes important to ascertain whether either party is at liberty to drain away the water which affords support to the surface of his neighbour's land. A distinction must here be drawn between water collected in ponds, or reservoirs, or flowing in well-defined channels, and water which comes no one exactly knows whence and flows no one knows exactly how, either underground or on the surface, unconfined in any channel, either as rainfall or from springs of the earth, which may vary from day to day, or spring up from beneath the surface in a direction from which no one knows. Water flowing in a well-established channel is, as we all know, not the subject of property. It is the subject only of usufruct. Standing water, on the other hand, is the subject of property. But water which percolates underground from many different sources is not regarded in the

same light, and, "although there is no doubt that a man has no right to withdraw from his neighbour the support of adjacent soil, there is nothing at common law to prevent his draining that soil, if for any reason it becomes necessary or convenient for him to do so."

But the Court will restrain a landowner who, in draining his land, at the same time draws off the water flowing in a defined surface channel through the adjoining land, as in the case of *The Grand Junction Company* v. *Shugar*, and for the reasons there given by Lord HATHERLEY: "If you cannot get at the underground water, without touching the water in a defined surface channel, I think you cannot get at it at all; you are not, by your own operations, or by any act of yours, to diminish the water which runs in this defined channel, because that is not only for yourself but for your neighbours also, who have a clear right to use it and have it come to them unimpaired in quality and undiminished in quantity" (*x*).

### THE RIGHT OF SUPPORT FOR BUILDINGS FROM LAND.

Although, as I am compelled to repeat, every man has a natural right to the support of his land from that of his neighbour, he has no such right to support for any artificial weight or building which he may place upon his land; and, if a man builds to the utmost extremity of his own land, and the owner of the adjoining land digs in his land so as to cause the building to fall in, no action will lie for the injury so occasioned, for otherwise it would be to place a restriction upon a man's legitimate use of his property. Neither party has any right to increase the natural right to support to which all land is entitled by imposing an additional weight on his land; there is, therefore, no natural right of support for an artificial weight or building placed upon land from

land of the adjoining owner (*y*). When a man erects a building at the extremity of his land, which requires and receives support from the adjoining land, he by this act endeavours to impose a burden on his neighbour, which would deprive him of the full enjoyment of his property. He has, therefore, no right to complain if his neighbour, in exercising his legitimate rights of property, withdraws the support from the building so erected. But a man must be careful in so acting not to withdraw the support to which the land itself is entitled in its natural state. This is a question of degree which would largely depend upon the nature of the soil and other special circumstances, and which it is the duty of a jury to decide. And in this view it is of course unimportant whether the building upon the land be ancient or modern. If the jury find that the falling in of the land was not owing to the artificial weight, but to the wrongful removal of support from adjacent land to which the land itself was entitled, the owner of the building will be entitled to compensation for the injury to the building caused by the falling in of the land (*z*), and the measure of damage will be the value of the building as it stood. It will be remembered that the original right is not in any way affected by the fact that the owner may have increased the weight of his land by building. He is still entitled to the support for his land, but to no greater extent than the land itself requires. We have now, therefore, to consider whether any such right of additional support for buildings in respect to adjacent or subjacent land can be acquired, and, if so, what circumstances are sufficient in law to establish such a claim.

### *Presumption of Grant.*

Rights of this sort, says Mr. Baron Alderson (*h*), "If they can be established at all, must, we think, have their

origin in grant. If a man builds his house at the extremity of his land, he does not thereby acquire any right or easement, for support or otherwise, over the land of his neighbour; he has no right to load his own soil so as to make it require the support of that of his neighbour, unless he has some *grant* to that effect." The unsatisfactory and conflicting decisions upon the construction of the Prescription Act have already been adverted to. The tendency of more recent law seems to indicate an increasing hesitation on the part of the judges in directing a jury to presume a grant of a right to support, after twenty years' enjoyment, by the dominant tenement. But it is only very recently that the true nature of the easement of support has been frankly admitted in the courts. In *Wyatt* v. *Harrison* (1832) (*y*), Lord Tenterden said: "The question reduces itself to this, whether, if a person builds to the utmost extremity of his own land, and the owner of the adjoining land digs the ground there so as to remove some part of the soil which formed the support of the building so erected, an action lies for the injury thereby occasioned. Whatever the law might be, if the damage complained of were in respect of an ancient messuage possessed by the plaintiff at the extremity of his own land, which circumstance of antiquity *might* imply the consent of the adjoining proprietor, at a former time, to the erection of a building in that situation, it is enough to say in this case that the building is not alleged to be ancient, but may, as far as appears from the declaration, have been recently erected, and if so, then according to the authorities, the plaintiff is not entitled to recover. It may be true that if my land adjoins that of another, and I have not by building increased the weight upon my soil, and my neighbour digs in his land so as to occasion mine to fall in, he may be liable to an action. But if I have laid an additional weight upon my land, it

does not follow that he is to be deprived of the right of digging in his own ground because mine will then become incapable of supporting the artificial weight I have laid upon it."

In the subsequent case of *Humphries* v. *Brogden* (*f*), already mentioned, Lord Campbell admitted the difficulty of discovering whence the grant of the easement in respect of a house is to be presumed, as the owner of the adjoining land *cannot prevent* it being built, and may not be able to disturb its enjoyment without the most serious loss or inconvenience to himself. The difficulty, however, did not appear to have much weight with the learned Judge when opposed to the principle of law which, he stated, "favoured the preservation of enjoyments acquired by one man, and acquiesced in by another who has the power to interrupt them."

Now, admitting such a rule of law to exist in its full force, it is hardly applicable to the acquisition of the easement of support, which, as Lord Campbell himself admitted, it was practically *impossible for a man to prevent.* The disability thus imposed upon a man whose property is attempted to be burdened by an easement of support, was fully recognized by the Lord Chief Justice in the most recent case of *Angus* v. *Dalton* (*i*), as tending strongly to negative the presumption of a grant even after twenty years' actual user and possession.

*Houses badly built, or insecure.*

Supposing, however, that there are circumstances from which the law will presume a grant of a right to support, the servient owner must be careful to respect the right so acquired over his land, and if the adjoining house be in an insecure condition, or badly constructed, and it is entitled to support from his land, the servient owner must not do any-

thing to accelerate the fall. Nor will the bad or ruinous condition of the house be any justification for even such a partial removal of support as would have been immaterial had the house been well built or in a secure condition, and this is the case even supposing the house to be so far out of repair that "in the ordinary process of decay it would have fallen in a short time" (A[1]).

*Alterations or Additions to Buildings.*

But, on the other hand, the dominant owner must be careful not to do anything to increase the weight of the building for which he has acquired a right of support (2). He must not build new buildings, nor increase the weight of the old buildings, for he will have no right of support for the *additional weight* thus imposed. Neither must he alter the construction of his building so that it will *require more support* than formerly; and if damage be sustained by reason of the additions or alterations so made, which would not otherwise have occurred, the party injured has no right of action. Whether the damage was the direct result of the additions or alterations, or whether the original right has been infringed, would seem on principle to be a proper question for a jury to decide. There is, however, strange though it may appear, no case in which this point has been directly raised. Mr. Justice WILLES thought that the right to support would be lost by the act of the dominant owner in increasing the weight of his building. In the case of *Murchie* v. *Black* (A[2]), the learned Judge is reported to have said, "This is not like the case of ancient lights, but an additional weight placed upon an old wall, and thereby the entire building must be treated as one weight, just as if a carpenter were to make a table capable of sustaining one hundred weight, and a person were to put half a ton upon it, and the table were to break in consequence of the increased

pressure, could any complaint be made against the carpenter?" We cannot assume, in the absence of direct authority, that the right of support for a building may not be altogether lost in the manner indicated, but it is clear that the right of support for buildings from land does not exist as a natural right, but is an easement in every case to be acquired.

There remains now the third and last division of the subject as to how far, and under what circumstances, one building is entitled to support from an adjoining building.

### Support for Buildings from Buildings.

There are two principles that must be carefully borne in mind: First, that there exists no *natural* right to support for one house, from another or adjoining house. Second, that no right of this kind can be *acquired* by prescription; that is to say, that the mere fact of a house having stood and received the support of an adjoining house for a period of twenty years does not, in itself, create an easement involving a *right* to the support so enjoyed.

It has been shown that such a right does not come within the operation of the Prescription Act. It can, therefore, only be acquired by *grant* express or implied. Thus, if there is evidence to show that the adjoining houses were, originally, built so as to depend one upon the other, whilst the property was in the possession of the same owner, a grant will be implied of a mutual right to support. But, in the absence of such evidence, the mere fact of juxtaposition raises no such presumption, and the question must depend upon the "other circumstances" to which we have already alluded when discussing the manner in which a right to support may be acquired.

In the case of *Solomon* v. *The Vintners' Company* (*g*), Lord Chief Baron Pollock said—"It is extremely difficult

to see how the circumstances of the houses having stood for twenty years makes any difference or creates a right, where houses are supposed to have been built by different adjoining landowners, each with its own separate and independent walls, but that upwards of twenty ago one of them got out of the perpendicular, and leaned upon, and was supported in part by the other, so that if the latter were removed the other would fall. The question is, whether any right of support is thereby obtained. It cannot be a right by prescription, which supposes a state of things existing before the time of legal memory."

The facts of that case are thus stated by the Lord Chief Baron, in his judgment in the Court of Exchequer: "The plaintiff complained of an injury occasioned to his dwelling-house by the taking down and removal of two houses, the defendants' property, under the circumstances hereafter mentioned. The facts proved at the trial were these:—the plaintiff was the owner of a house in Pilgrim Street, in the City of London. His house was built on a hill, having a descent towards the west. There was a house next below his, and adjoining to the plaintiff's house, belonging to a third person, and the defendants were the owners of the two houses next adjoining. One of the defendants' houses was a corner house of the street, and the other was in the adjoining street. For upwards of thirty years the four houses were all of them out of the perpendicular, leaning to the west, and this might have been seen by any one passing by. There was no evidence how or when this occurred, or when the houses were built, or that there was any connection between the houses, either in title, occupation, possession, or otherwise. In 1857, the lease of the defendants' houses expired, and they entered into a contract with a person of the name of Robins that he should pull them down and erect two other houses in their place; and that,

upon this being done, they would grant him a lease upon an agreed rent. Robins proceeded to pull down the houses, and in consequence damage was caused to the plaintiff's house. And the question is, whether these facts show any liability on the part of the defendants."

It was contended that the support being *openly enjoyed* for upwards of twenty years, the plaintiff had thus acquired a *right* to the support so enjoyed, but Mr. Baron Bramwell, in his judgment, while strongly opposing any such contention, stated the true principles upon which the claim was founded, as follows: "Now a thing cannot be enjoyed as of right, unless it is openly and visibly enjoyed. An enjoyment must neither be *vi precario* nor *clam;* it must be open. Now, when you see one house leaning towards another, you may make a tolerably shrewd guess that it is partly supported by the other, but it is a guess; you cannot tell. It may be that they have both slipped, and both stand self-supporting; and it may turn out, and it may be the fact, that the house which leans towards the other affords as much support to that other by the two being joined, or sticking together in some way or another, as the other affords to it. One cannot tell upon the face of it that it is being supported. . . . And therefore, to my mind, supposing that the plaintiff for more than twenty years had an enjoyment which he says now ought to continue, it was an enjoyment *clam,* not open, and consequently, not as of right."

From the reasons expressed in the judgments just quoted, it is clear that, whatever prescriptive right of support may exist with regard to the support to buildings from adjoining land, no such prescriptive right can be claimed for mutual support in the case of contiguous buildings, either by statute or at common law. It is true that it has been held (A[1]) that a man is bound to use due care and skill in pulling

down his house so as to do as little injury as possible to his neighbour, but there is no authority to show the degree of care required, nor any rule to guide a jury to a conclusion on such a point. Where, however, there is a concealed vault or a quicksand, of the existence of which the defendant had no notice, he has been held to be exonerated from the consequences, for one degree of skill would be required where the soil was in its natural condition, and another where there is a vault; another and still greater degree of care would be required where the adjoining vault is of weak and fragile construction. How is the defendant to ascertain the precise degree of care and caution the law requires of him if he has no notice of the existence of the structure? "We think," said Mr. Baron PARKE, "that no such obligation as that alleged exists in the absence of notice" (A[3]). Neither is there any obligation imposed by law upon a man to shore up his neighbour's house after removing his own (*k*); nor yet to give notice to his neighbour of his intention to remove his house (A[3]).

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I have now concluded this necessarily imperfect sketch of the law of support. The difficulties with which the subject is surrounded are obvious, and litigation must be productive of uncertain and perhaps unlooked for results so long as the law on this important question can only be gleaned from the *dicta* of the judges. And these, having always especial reference to the particular state of facts under consideration, can seldom be said to apply with equal force to any other circumstances than those to which they were originally intended to apply, and it rarely happens that in any two cases the circumstances are precisely similar.

It is evident that the absence of any precise rule of law must lead to inconsistencies and contradictions. As we have seen, the law allows the acquisition of an easement of support for buildings from adjoining land, by prescription, but refuses to allow of any such right with regard to contiguous buildings, the chief reason being that the support in the latter case is the nature of things enjoyed by *stealth*, without either party being certain of the fact; but this reason applies with equal force to the support of a building derived from land, which is in its character as stealthy and uncertain as the former.

The modern device of presuming a grant, which is also productive of great inconvenience, was evidently resorted to in order to remedy an oversight in the framing of the Prescription Act. The object of that Act, as I have already shown, was to abolish fictitious presumptions, whilst, in this case, its effect has been to render more obscure the prinicple of the common law upon which the theory of a lost grant previously rested.

The law is, admittedly, in a very unsatisfactory condition, for the owner of a building cannot for a certainty tell whether he is or is not entitled to support from his neighbour's land or building. Neither, on the other hand, has that neighbour any *reasonable means* of preventing the acquisition of a claim which, if it be not an absolute legal right, may, nevertheless, be productive of serious embarrassment. It is, therefore, in the interests of all parties that these rights, in their nature so important, should be placed on a satisfactory footing by some comprehensive enactment, which should define the limits of prescriptive rights with regard to all easements, and at the same time provide some simple and expeditious means by which the owner of property over which any easement is sought to be acquired may express his dissent in a legal and formal manner, and thus prevent the acquisition of a right to support, should he desire to do so. At present the only safe

course open to those who would avoid expensive litigation or serious loss is to be found in mutual agreement and compromise.

## AUTHORITIES CITED.

(*a*) 10. Digest. 1, 13. D. 8, 3,33.
(*b*) Code Napoleon.
(*c*) White's Recopilacion.
(*d*) General Civil Code of Austrian Monarchy—Winiwarter. Institutes of the Laws of Holland—Vander Linden. Code Civil du Royaume D'Italie—Gandolfi.
(*e*) Rolles' Abridgment 2, 564.
(*f*) Humphries v. Brogden. 12 Q. B. 739., 20 L. J., Q. B. 10.
(*g*) Solomon v. Vintners' Company. 4 H. and N. 585, 28 L. J., Ex. 370.
(*h*) Partridge v. Scott. 7 L. J. N. S. Ex. 101.
(*i*) Angus v. Dalton and the Commissioners of Works and Public Buildings. Q. B. D. Dec. 1877.
(*k*) Peyton v. Mayor and Commonalty of London. 9 B. and C. 725.
(*l*) Richards v. Rose. 9 Ex. 218.
(*m*) Mounsey v. Ismay. 34 L. J. Ex. 52.
(*n*) Corporation of Birmingham v. Allen. 46 L. J., ch. 673, 37 L. T, 207.
(*o*) Bonomi v. Backhouse. 9 W. R. 767, 9 H. L. C. 503.
(*p*) Wakefield v. Duke of Buccleuch. L. R. 4 Eq. 613. 36 L. J., ch. 763.
(*q*) Harris v. Ryding. 5 M. and W. 60, 8 L. J. N. S. Ex. 181, and cases there cited.
(*r*) Hilton v. Lord Granville. 5 Q. B. 701.
(*s*) Aspden v. Seddon. L. R. 10 ch. ap. 714, 1 Ex. D. 496.
(*t*) G. W. R. Company v. Bennett. L. R. 2, H. L. 27. G. W. R. Company v. Fletcher. 5 H. and N. 689, 29 L. J., Ex. 253.
(*u*) Eadon v. Jeffcock. L. R. 7, Ex. 379.
(*v*) Smith v. Darby. L. R. 7, Q. B. 716.
(*w*) Robotham v. Wilson. 8, H. L. C., 362.
(*x*) Elliott v. N. E. R. Company, 10 H. L. C. 333. Grand Junction Canal Company v. Shugar. L. R. 6 ch. ap. 483. Popplewell v. Hodgkinson. L. R. 4, Ex. 248. Chasemore v. Richards. 7, H. L. C. 349.
(*y*) Wyatt v. Harrison. 3 B. and Ad. 871.
(*z*) Stroyan v. Knowles. 30 L. J. Ex. 102, 6 H. and N. 454. Brown v. Robins. 28 L. J., Ex. 250, 4 H. and N. 186.
(A[1]) Dodd v. Holme. 1 A. and E. 493.
(A[2]) Murchie v. Black. 34, L. J., C. P. 337.
(A[3]) Chadwick v. Trower. 8 L. J. N.S. Ex. 286.

Mr. C. G. Grey (Member) proposed a vote of thanks to Mr. Smalman Smith, for the Paper which he had so kindly prepared, and which had doubtless been listened to with much satisfaction by all the Members. It was however of so technical a character, that it would be impossible to discuss it without a careful perusal, and he would therefore suggest the adjournment of the discussion to the next Meeting.

There were one or two points which occurred to him at the moment to which he might, perhaps, be permitted to refer. He had in his mind's eye three plots of land, which had been conveyed to different owners, but the rights to work the minerals, without breaking the surface, had been reserved. On one of these plots had been built large schools, on another a chapel, and on the third some very heavy stone works supporting reservoirs. It was conceivable that the minerals might be worked out without damage to the schools or the chapel, but that the great weight of the water-works might break the surface down, and let the water into the mines below. It would appear in this case that the working of the minerals had not done such damage as to injure the natural stability of the surface for ordinary purposes, but that the damage was owing to the undue weight of the reservoirs. He gathered from the Paper, that the owner of the reservoirs would not be able to recover compensation from the owner of the minerals, but that the owner of the minerals might possibly be able to recover damages for the drowning of his works.

Another point which was not clear to his mind was this. It would appear that in some cases the owner of minerals might be entirely prevented from working them, even subject to the obligation of paying for any damage resulting to the surface from his operations. It would be remembered that in the case of common and other lands, where rights were

reserved, full liberty was given to work the minerals on condition of making good any damage done to the surface. These and other points to which he might have referred, struck him, during the reading of the Paper, as worthy of discussion at the next Meeting, by which time the Paper would be in the hands of all the Members.

Mr. A. Garrard (Associate) had much pleasure in seconding the vote of thanks, and quite agreed with Mr. Grey, that it would be well to adjourn the discussion in order that Members might be better prepared to do justice to the Paper than was possible that evening.

The President said that it appeared to be the general wish that the discussion should stand adjourned until the next Meeting; meanwhile he had the pleasure of conveying to Mr. Smith, on behalf of the Members, an expression of their thanks for his kindness in preparing a Paper on so important and interesting a subject.

The vote of thanks was put and carried unanimously, and the discussion was adjourned to the next Meeting.

AT

## THE ORDINARY GENERAL MEETING,

*Held on Monday, February 11th,* 1878.

THE PRESIDENT IN THE CHAIR.

The discussion on the Paper read by Mr. J. Smalman Smith, at the last Meeting, entitled "The Law of Support in its Relation to Land, Mines, and Buildings," was resumed by—

Mr. C. G. Grey (Member) who said that, as a layman, he could not pretend to criticise the law as laid down by Mr. Smith, but there were one or two points in the Paper which seemed to him to call for some comment, and to which he proposed, with the permission of the Meeting, to refer.

In his introduction to the subject, Mr. Smith seemed to imply that the ownership of the surface and the ownership of the minerals were vested in different persons "in a manner peculiar to England." It would be inferred from this that in foreign countries the owners of the surface were owners also of the minerals. He believed, however, that this was not so. In Spain, as Mr. Smith himself had said, and in France, mines were held by concession from the Government. He (Mr. Grey) did not know what the law was with regard to the rights of the holders of minerals from the Government over the surface, but they certainly did possess some rights, for they could not only work a mine, even though they allowed the surface to subside, but they

had powers to take certain lands for the erection of buildings, compensation in respect of which was regulated in some measure by Government procedure. Mr. Smith had given a brief sketch of the laws obtaining at different times and in different countries, beginning with the Roman civil law. He pointed out that, under the provisions of that law, a space was to be left between boundaries of property under certain circumstances. For instance, a man planting a hedge must not dig into his neighbour's ground, and if he built a wall, he must leave a foot between it and his neighbour's land. With reference to this point he believed it was the custom, if not the law, for railway companies to plant their hedges four or five feet from the edge of any land purchased by them. Was this of necessity the case in building walls, as the mason could not otherwise work without trespassing on the adjoining land?

Turning to the subject of Mines, the right to break the surface or let the surface down, depended on the nature of the tenure or contract, and there seemed to be little doubt that every case must rest on its own merits, as interpreted by the light of the agreement or the grant under which the property was held. It was laid down as an axiom that no man was at liberty to use his land in a manner hurtful to his neighbour. As a general precept this was perfectly true, but the Paper seemed to show that there were cases in which a man ought to have, if he had not, the right, to some extent, to encroach on his neighbour's right in the use and enjoyment of his own.

The case which struck him most forcibly in connection with this point was one mentioned in the Paper, viz., that of *Wakefield* v. *The Duke of Buccleuch.*

This case probably possessed some features of very unusual occurrence, for his impression was that as a general rule the rights of the owner of the surface and those of the

owner of the minerals were regulated either by grants, by Inclosure Acts, or by some definite and tangible form of agreement. It appeared however, in the case alluded to, that the owner of the surface and the owner of the strata below held their separate properties without any kind of legal or even traditional relation to one another; and in this case it seemed to have been decided that, although the mineral property was of great value, the owner of it (The Duke of Buccleuch) could not work it, even if willing to compensate to the utmost the owner of the surface for any damage sustained by him from the operation. He inferred this, at any rate, from the fact that the plaintiff in the case obtained a perpetual injunction against The Duke of Buccleuch, and his lessees, from working the minerals, because they could not be worked without injuring the surface.

The President thought that this particular case was afterwards carried to the House of Lords, and over-ruled.

Mr. Smalman Smith (interposing) said that, if he might be allowed at that stage of the discussion to state exactly the facts with regard to this case, some misconception on the point might be avoided. The case of *Wakefield* v. *The Duke of Buccleuch* was carried to the House of Lords, on appeal from the judgment of Vice-Chancellor Malins. The Lord-Chancellor did not then dissent from the general principles as laid down by Vice-Chancellor Malins, but emphatically stated that the case did not depend on general principles, but upon the terms of the Inclosure Act in question, and on the true construction of that Act. The decision of Vice-Chancellor Malins was ultimately reversed. He (Mr. Smith) when discussing general principles had only cited that case as an illustra-

tion of the varying nature of the strata, and the consequent difficulty in working the minerals, in some cases, without disturbing the surface.

Mr. Grey (resuming) said that he was not aware that there was an Inclosure Act involved in the case. The general principle, however, to which he had alluded held good, and, if it were an established principle, it seemed to him to be very important that the law should be altered. In a case such as that of *Wakefield* v. *The Duke of Buccleuch*, the surface might be moor-land of very small value, while the minerals might represent a very great value, and, in a country like England, depending so much on its mineral resources, it would be contrary to public policy that the interest of the private owner should be suffered to prevail over the public advantage, and result in the locking up of a large amount of mineral wealth. He contended that if such a decision were arrived at, as he understood was come to in that case, the law required amendment. Encroachment on the rights of private owners, in the public interest, was no new thing, and was illustrated continually by the compulsory powers accorded to railway and other companies; and it could not be contended for a moment, in these days, that a private individual could be allowed to refuse to part with his land out of a spirit of resistance to the construction of a railway, —though such things had happened within his recollection.

The Author had said (page 106) "When the surface is conveyed it must, *primâ facie*, be presumed that the minerals are to be enjoyed, and therefore that a power to get them must also be granted or reserved as a necessary incident." Now, if the surface were conveyed without any mention of minerals whatever, the question which occurred to him was, How are the mineral rights affected by it?

Probably the simplest way to explain what he meant,

was to instance a case in point in which a lease for 1,000 years was granted of certain lands, and no mention whatever was made of the minerals. He did not think it was contended by the lessee that the minerals were conveyed with the land, but that the owner of the minerals could not enter upon the land to get them without committing a trespass. He believed that he was correct in this view, but, if not, he might observe that Mr. SMITH had not given any information on the point. But the case went still further: how would it be if the person who worked the minerals did not disturb the surface? If he disturbed the surface simply by letting it down by working his mine, could the owner of the surface obtain a perpetual injunction against him for the remainder of the 1,000 years, lest he let the surface down half a foot; or was it open to the owner of the minerals to secure immunity from any further proceedings by paying the owner of the surface compensation for the damage he had done? In the particular case in point, the lord of the manor granted power to the lessee to cut and fell timber for repairing his harrows, &c., and, although he did not specifically reserve the timber, it was fair to infer from that fact that the timber was reserved as well as his power to fell and carry away timber for sale. The minerals, however, were not mentioned at all, and the case was therefore somewhat different.

He must confess there had been considerable confusion in his mind with reference to the law of support to land from underground water. The question seemed to him to be a very difficult one. He could conceive a case in which a large body of water was covered by such impervious strata that it supported the land upon it; but if, on the other hand, the strata were at all pervious, the land would probably receive but little support from the water, since it would gradually press the water out at whatever point it could

escape. But suppose the first-mentioned condition of things to exist under two properties, and one owner sunk a well, or bored a hole. In that event it might well happen that the pressure of the overlying strata would be so great that the water would rise to the surface and form an Artesian well, which might go on discharging itself until all the water was exhausted from below, and the land would be left without the support it had previously enjoyed. Members were all aware of the law as to interference with water running on the surface of the land. There were cases also where wells had been dried by the sinking of mines, and to which Mr. Smith had not referred in his Paper.

He had certainly obtained a great deal of information from the Paper, and had found in it confirmation of a good deal which he had already seen in practice, and enlightenment on certain points which had not previously come to his knowledge. On the last occasion he had cited three cases which were to some extent imaginary, because the grants were not exactly as he described them; but they raised in his mind a rather curious question as to what weight of buildings a man might put upon land with safety, having regard to the working of the minerals beneath them.

Mr. Hugh Shield (Associate) had read the Paper with much interest, and congratulated the Author on the satisfactory accomplishment of his purpose of giving a summary of the Law of Support in a form at once concise, comprehensive, accurate and interesting—at any rate to the legal reader.

There was a good deal of very solid ground to go over in dealing with the question of the right of support. The support, for instance, which a man was entitled to receive from adjoining lands needed no demonstration. With regard, however, to a class of cases which arose in the north of England in

connection with mining operations, there was room for much profitable discussion, turning upon questions of surface disturbance and the degree of damage sustained therefrom. So far as he was able to follow the cases put by Mr. GREY, they did not present any great difficulties to his mind. There was, of course, room for great difference of opinion as to the effect of mining operations upon the overlying land; but the general law in such cases was tolerably clear, and it was this, that, when the minerals belonged to one person and the surface to another, the owner of the minerals could work the minerals only subject to the obligation of leaving sufficient support to the surface.

Some observations had been made with reference to mining leases. The usual spirit in which such leases were drawn was this:—The owner, in effect, said to the mining lessee, "You are not only to be authorized, but bound, to recover all the coal below." This, however, was generally tempered by an arrangement whereby compensation could be recovered for any injury resulting to the surface from the mining operations. On the other hand, some leases were constructed on terms which gave the lessee much less freedom of action. All controversy arising on questions of the sort really turned upon the construction of the lease: was it or was not it the intention of the lessor that the mining lessee should have this absolute power—in some cases the absolute duty—of removing the whole of the minerals below? Cases frequently arose such as he and his friend Mr. WHEELER (whom he saw in the room) were engaged in, where a house depended for support upon another house on the estate of an adjacent owner In such a case, had the neighbour a right to claim a continuance of that support? As the law now stood, or, perhaps he ought rather to say, as the law stood on Saturday night, the right to a continuance of that support depended entirely

upon the special circumstances of the case. If the law be as Mr. Justice Lush had ruled, the mere fact that a house had stood for a period of over 20 years entitled the owner to a continuance of support. But, in a judgment of great learning and great length, the Lord Chief Justice had distinctly laid down a very different proposition—namely, that the existence of any such right depended entirely on circumstances. If the facts were such as to point to a presumption of a grant of support there was a right to the support, but, if the facts were such as not to favour, but to negative that presumption, then there was no right to that support.

The particular case in point was that of *Angus* v. *Dalton*, the facts of which might be worth relating. At Newcastle-upon-Tyne, Her Majesty's Government had established a Probate Office, and they bought for the purpose a very old house, next door to an old-established coach factory belonging to Messrs. Ainger. Those two houses had stood side by side for over one hundred years. About twenty-seven years ago the house, which was now a coach factory, had been converted from a private dwelling house, and the alterations then made were such as to entirely alter the call which Angus's house made on the adjoining land for support; for whereas the old house had been built in a normal and usual manner, and only called for the usual degree of support, the alterations in the structure entirely altered it; and the making of these alterations (such as iron girders to hold the roof and carry heavy loads), so altered the disposition of the weight as to throw it upon a particular point, so that from that period (twenty-seven years) Angus had made a call for support, of an abnormal and unusual character, on the adjacent land. The Lord Chief Justice held that, inasmuch as the neighbours (from whom the Government bought), who owned the adjoining house, had

no knowledge of the sort of demand which was being made on them for support by the adjoining house, they could not have been held to have granted a right of support; and therefore, although the user had been enjoyed for twenty-seven years, there was no right to it. In fact, according to the judgment of the Lord Chief Justice, the right of the enjoyment depended upon the presumption of a grant. No period was fixed for a prescription, the lapse of which was supposed to mature the user into an absolute right. The Judges, by analogy to a statute passed for an entirely different purpose, had fixed an arbitrary period, dating back to the year when King Richard I. returned from Palestine; and this was the period of prescription recognised by the English Common Law.

Those, therefore, who affected to say: "I have used a certain privilege so long, that it has become an absolute right," were required to prove that it had been enjoyed since Richard I. returned from Palestine—a difficult thing to do. The Judges, however, had met the difficulty by adopting the analogy of another statute, passed in the time of James I., which limited the time within which actions might be brought for the recovery of lands, to twenty years, and they said: "We will direct the jury that they must presume the right existed ever since the time that King Richard I. returned from Palestine." So things went on, until people began to rebut that presumption, and showed, in many instances, that, although the right had been exercised for twenty years, yet there was a time subsequent to the return of King Richard I. from Palestine, when a different state of things existed, and the presumption became disproved. That led to this further device, "Prove to us that you have enjoyed it for twenty years, and we will direct the jury that they must presume a grant." That was the present state of the law as regarded the right of support from

buildings; and it would remain so, until the case of *Angus* v. *Dalton* was settled by a higher tribunal.

Mr. T. Chatfeild Clarke (Member) thought that the Members were under great obligations to the legal gentlemen who favoured the Institution, from time to time, with these expositions of the law on various subjects of interest to Surveyors. It was not the first time that excellent Papers of the kind had been read in that room, and no one appreciated them more than he did; but he felt bound to add this qualification, in the interest of candour, that there were certain things in Mr. Smalman Smith's Paper which he would not advise any young practitioner to accept as authoritative, but would rather counsel him to follow the reverse. He referred more particularly to a passage in page 116, where the writer of the Paper quoted these words of Mr. Baron Parkes: "Neither is there any obligation imposed by law upon a man to shore up his neighbour's house after removing his own; nor yet to give notice to his neighbour of his intention to remove his house" He could only say to any young practitioner in the room, that, if he wanted to land his client in hopeless litigation and unrest, the best thing he could do was to take that advice. He (Mr. Clarke) would recommend him, on the contrary, to give his neighbour full notice to shore up his house, and do nothing except in a courteous way, and endeavour to act so as to avoid litigation.

There were questions not dealt with in the Paper which were of great practical interest to men who were every day engaged in building operations. He noticed that no reference was made to the question of party-walls. He presumed that most of the gentlemen in the room knew that, as the law stood in London, an external wall and a party-wall were two different things.

A question which often arose, and which he should have been glad to have seen dealt with in the Paper, was this: supposing two external walls, neither of which was sufficient to support the buildings if the other were removed; in this case, ought the one owner, if he proposed to remove his building, to call on his neighbour, on his side, to shore up his building, or was his neighbour entitled, under the law with respect to easements, to compel him to give support on his side? This was a most interesting question, and it was very desirable to know how the law really stood as regarded it. The tenor of the law, as he understood it, was against compelling a man to give lateral support by shoring; but, as a matter of practice, were it not customary to provide shoring of the kind, the results would have been most disastrous in many cases within his knowledge. Another question which sometimes arose in connection with the law of support from adjacent buildings, and which had been referred to by Mr. I'Anson elsewhere, was this: it was not an uncommon thing for an ancient building to lean over at the top, to the extent of nine, eleven, or twelve inches. In a case of this kind, what were the rights of the adjacent owner? Was he bound to erect his building at a distance of a foot, or whatever it might be, from the base of his neighbour's overhanging wall, or could he commence his building at the foot of that wall, and, as it were, build his neighbour's wall in? Perhaps Mr. Smalman Smith could enlighten them on the point.

Another difficult question in connection with the practical working of the Building Act, was that of the projection of footings. A case came under his notice not long since, where a man leased to another a piece of land extending up to a certain line, contiguous to a footway. The lessor refused to allow the lessee to extend his footings beyond this line, maintaining that he should set his buildings back,

so as to give room for the number of footings required under the provisions of the Metropolitan Buildings' Act, and not project the footings on to his land.

Then, again, there was an important and to some extent cognate question connected with the law of easements. Suppose the case of an ancient water pipe, or waste pipe, delivering from a roof or cistern over a low building, and assume that the owner of this low building proposed to carry it to a greater height, and that the adjacent owner had an uninterrupted right of running his water over the adjoining low roof. It was sometimes extremely difficult to arrange matters of this kind without litigation, where there had been acquired, it might be considered by time, the right of running water over an adjacent roof. Questions as to the cellarage of houses frequently arose, and involved some curious points. It was not an uncommon thing to find the cellar of one house running under the adjacent house. He also knew a case near Hatton Garden where the upper portion of one house ran over the next house, and that house, again, over another portion of the former house. All these were intricate easements, and the solution he would suggest was the appointment, under statute, of skilled referees who, without an expensive procedure, could efficiently deal with these questions of easements whenever they arose.

In conclusion, while thanking the Author for his ably-written Paper, he could not help thinking that it was safer to deal practically with these questions than to rely upon mere maxims of law, which would tend to land those who trusted to them in positions of very considerable difficulty.

Mr. J. Shaw (Member) said that he had not had the opportunity of studying the Paper as a whole, but his attention had been arrested by a passage in the latter part of it (page 117) where the author said: "The law is admittedly

in a very unsatisfactory condition," and then went on to say that it was in "the interests of all parties that these rights, in their nature so important, should be placed on a satisfactory footing by some comprehensive enactment, which should define the limits of prescriptive rights with regard to all easements, and at the same time provide some simple and expeditious means by which the owner of property over which any easement is sought to be acquired may express his dissent in a legal and formal manner, and thus prevent the acquisition of a right to support, should he desire to do so." He entirely agreed with the Author's recommendation, but must confess that he saw very great difficulty about the framing of any enactment which should be applicable to the great variety of cases which arose. The best way in his opinion to deal with these matters was to follow the usual and most natural interpretation of the law, and apply it according to principles of common sense—in fact, as the author had said in the concluding sentence of his Paper,—"At present the only safe course open to those who would avoid expensive litigation or serious loss is to be found in mutual agreement and compromise." This was also the lesson which he drew from his own experience; for he had found that in almost every case in which he had been concerned where resort had been had to litigation, considerable ultimate loss had been sustained.

Allusion was made by Mr. Grey at the last Meeting to the support of water upon the surface. Alluding to reservoirs, he said that "he gathered from the Paper that the owner of the reservoirs would not be able to recover compensation from the owner of the minerals, but that the owner of the minerals might possibly be able to recover damages for the drowning of his works." Now, he would give two instances, drawn from his own experience, with reference to this point. The first was the case of an exten-

sive colliery in Nottinghamshire. Nearly twenty years ago, attempts were made to sink shafts a quarter of a mile or so from a large reservoir, but it was found to be impracticable to do so owing to the leakage from the reservoir. The reservoir was the property of a Canal Company, and application was made to the owners to let off the water in order to admit of the sinking of the shafts. The Canal Company, however, refused at first to do so, but ultimately, seeing, he supposed, the position they were in, did as they were requested. As soon as the water was let off, means were adopted to prove that the water had passed from the reservoir into the pits, and the consequence was an action at law and heavy costs. If the Canal Company had exercised common sense in the first instance, all this would probably have been avoided.

Another case in which he had been concerned was in connection with a canal resting upon a porous rock. The land on which the canal was constructed was the property of one owner, while the land on the other side of an adjoining fence belonged to another owner. There were mines on the second owner's land which were leased to a company, who brought an action against the Canal Company for damage by reason of the water passing into their mines from the canal. He (Mr. Shaw) looked into the matter, and reported that the damage could be stopped for an outlay of something under £300. Other advice, however, prevailed, and the end of it was that the action was brought and it was found that they had an undefended case; but on the evidence of a very eminent mining engineer, who thought there was an error in the mining plans, an adjournment of the trial was obtained, and it appeared on examination that the plans were in the first instance incorrect. The workings ran very close up to the boundary, but notwithstanding that fact, and the inaccuracy of the plans, the result was

against his company, and he had the mortification of having to pay, on behalf of his company, between £5,000 and £6,000 for what might have been settled in the first instance for an outlay of £300, and the leakage was ultimately stopped for less than that sum. He believed in taking a common-sense view of these matters, and common sense was generally a sufficient guide in all cases of the kind. At the same time he thought the Institution much indebted to the Author of the Paper for the clear exposition he had given of the law.

Mr. E. Ryde (Vice-President) said, with reference to an observation of Mr. Grey's, that there was probably a time in this country when, in all cases, the minerals and the surface belonged to the same owner, and the minerals, as in The Duke of Buccleuch's case, had been separated from the surface as the result of various transactions in bye-gone times. There was no doubt that the lord of the manor was in former times the owner of everything, both substrata and surface. It was by legislative interference, so to speak, that the enfranchisement of the surface was brought about, and thus became separated from the minerals, which, in some cases, remained in the possession of the lord. It might happen, also, as Mr. Shield had said, that the minerals had been leased. It was obvious in this case that the right to support which either of such owners possessed depended entirely on the terms of the lease, and it seemed to be common sense that this should be so. The separation of the minerals from the surface might arise out of circumstances similar to a case within his knowledge, where an acquaintance of his bought an estate under which he knew that there were valuable minerals, and was fortunate enough to sell the estate, reserving the minerals, for as much as he bought it for, including the minerals. This and similar transactions had had the effect of separating

the ownership of the minerals from the ownership of the soil. He presumed that, as a matter of fact, the right of support in all these cases depended on the nature of the original transaction—on the presumption of a grant, or on what Baron MARTIN, he believed, used to call a "foundation fact."

The reservoir referred to at the last Meeting, was in all probability put in its position under the exercise of some compulsory powers, such as the Lands Clauses or the Railways Clauses Act; and the minerals, as a matter of course, would be subject to the provisions of the Act. The circumstances of such a case, therefore, were of a special and not of a general kind. The canal also, which had been alluded to, was in all probability constructed under the powers of a special Act of Parliament; and therefore, as in the case of the reservoir, the general principles laid down in the Paper were inapplicable.

He hoped that the Author of the Paper would inform the Meeting how the law was really left by the late decision in the case of *Wakefield* v. *The Duke of Buccleuch*, as it was of the greatest importance to the Institution, and to a very large number of readers who looked to the "Transactions" for authoritative information, to have the most accurate expositions of the law as to this and similar subjects.

Mr. T. W. WHEELER (Visitor) wished to make a few remarks as to the state of the law as exemplified in the case of *Angus* v. *Dalton*, in which he was engaged as counsel. He agreed with what had been said, that that which was the law last week might differ considerably from that which might be the law in a week or two. The case of *Angus* v. *Dalton* was really intended to raise a question which, owing to the astuteness of the counsel employed, was never raised at all, and the Court might be said to have decided the

case on its own findings, and not on the particular facts involved. The right of support of land by land was well known in the English law, but he ventured to assert that there was no obligation, in the absence of grant, express or implied, known to English law whereby one owner of a house had a right to have his house supported by another.

He might mention a somewhat singular case in connection with party-walls with which he had lately been concerned. It was a compensation case brought by a man named Jones against the Metropolitan Board of Works. The claimant had built a factory at the bottom of the Edgware Road, and in the factory was an engine. The boiler of the engine, if he remembered rightly, rested upon supports let into the wall, and that wall was itself supported by the gable end of an ancient building. The Metropolitan Board of Works, in widening the end of the Harrow Road, had occasion to take down this ancient building, and the result was to weaken the wall on which Jones's engine and boiler rested. A learned leader of the Home Circuit advised that no action should be taken at law, but that it was a case for compensation under the 68th Section of the Lands Clauses Consolidation Act, and compensation was awarded by a Sheriff's Jury.

The case of *Angus* v. *Dalton* had yet to be taken to the House of Lords; but, as regarded the question of the right of support of one house from another, the Members of the Institution of Surveyors might safely advise all their clients that, with the reservation above mentioned, no such right existed in the English Law.

Mr. J. Smalman Smith, in reply, said that he had undertaken the task of defining the law with respect to this difficult and complicated question with considerable hesitation, but felt encouraged by the manner in which the Paper had been received. Exception, it was true, had been taken

to some of his statements; but he thought that he should able to show satisfactorily in the course of his reply that he had not misinterpreted existing law, and that his statements as to matters of fact were correct. As regarded the observations of Mr. GREY, he must deprecate any attempt to draw wide inferences from statements contained in his Paper. In the earlier portion of the Paper he had stated the peculiar relations of the owner of the surface to the owner of the minerals, relations which he believed obtained in this country only. As a matter of fact, the confused condition of the English law on this subject was mainly due to the repeated efforts on the part of the Crown to assert its prerogative in respect to certain paramount proprietary rights in mines and quarries —a prerogative generally admitted throughout Europe as a fundamental principle of law, at any rate among the Latin races. He ventured to believe that the Crown had originally certain imperial rights in the whole of the minerals in this country, and it was only after a great deal of controversy and several severely-contested law suits, that the question was at all decided, and the independent spirit of the people successfully resisted the claims which were advanced on behalf of the prerogatives of the Crown. Notorious among these cases was the great case of mines, between *The Queen* and *The Earl of Northumberland*, in the reign of Elizabeth, in which it was held that, where copper ore contained gold or silver, such ore belonged to the Crown, to the exclusion of the owner of the mines.

The decision in this case, however, had not been generally followed, and the law continued in an uncertain state until the claims of the Crown were at length finally defeated in the Law Courts, in the case of Sir Carberry Price, but it was not, he believed, until the reign of WILLIAM and MARY that the rights of the Crown with regard to minerals were placed on a tolerably satisfactory footing. By a statute in

that reign, all ores containing copper, tin, iron, or lead were declared to be the property of the owner of the mines—notwithstanding the fact that they might contain gold or silver also—giving to the Crown, however, the right to purchase the ore after it had been raised. Subsequently the Crown's right of pre-emption, as it was termed, was settled by an Act in the reign of GEORGE III. He believed the only mines in which it could now be said that any proprietary rights existed on the part of the Crown were gold and silver, which were, in the English as in the Roman law, royal mines. There were, however, certain exceptional customs with regard to minerals existing at the present time in certain districts in England and Wales, by virtue of which the Crown still remained entitled to paramount proprietary rights in mines and quarries, and these customs were expressly excepted from the statutes of mines to which he had alluded.

Allusion had been made to the case of *Wakefield* v. *The Duke of Buccleuch*, and some misconception had arisen with reference to his remarks as to that case. On turning to pages 99-100 of the "Transactions," it would be seen that his remarks in connection with this case commenced with the enunciation of the principle that the degree of support to which the surface owner was entitled at common law was not affected by the nature of the subjacent mineral strata; and he quoted the case only as one affording an admirable example of the varying nature of strata, and not, as would be seen, as the authority for the principle. The quotation did not end at the word "granted" (page 100), but extended to the end of the paragraph. "When, therefore, from any cause, the rights of the surface owner and the owner of the minerals cannot co-exist, the question arises—which must give way? Mines must be regarded as a tenement subservient to the surface, and upon the principle

laid down in *Humphries* v. *Brogden*, 'The surface in its natural state, and unencumbered by buildings, is entitled to support from the minerals, whatever may be the nature of the mineral strata.'" Now that, he contended, was a very lucid exposition of the law as it now existed. The case, it was true, went to the House of Lords, but it was determined by that tribunal that it did not rest upon general principles, but turned upon the construction of a clause of a particular Inclosure Act. Lord HATHERLEY then said that the general propositions enumerated by the Vice-Chancellor did not help much to a solution of the case, and that the rights of the parties must be determined according to what we find in the instrument creating those rights—which, in this case, was a Special Inclosure Act; and it was held that, under the words of that Special Act the lord of the manor was entitled to work the mines to an extent which might reach to the utter destruction of the land above, subject only to the liability to pay compensation for the damage done. It was true that he had not adverted to the decision in the House of Lords, for the simple reason that, had he entered into the rules of law as to the construction of documents and Acts of Parliament, he would have occupied the attention of the Institution for many evenings to come. He had endeavoured to confine himself to the consideration of general principles only, and did not wish to encumber his Paper with the records of any decisions that were not strictly in point. Mr. GREY seemed to doubt the possibility of underground water affording support to land. This, however, was merely a question of experience, and he could only point to the cases that had come before the courts upon the question, to show the important distinction that existed in law between water which might be the subject of rights of property and water to which all were entitled either to use or get rid of. The cases that had been instanced by Mr. GREY and Mr.

Shaw of the flooding of mines by reason of the leakage of reservoirs or canals were generally governed by the provisions of special Acts of Parliament; but he might state that canal and waterworks companies were generally liable for the flooding of mines in the manner indicated, although mining operations might have caused the injury. He would content himself with referring to two cases in illustration of this principle, which was, however, somewhat beyond the limits of his Paper, viz., *Bagnall* v. *London and North Western Railway Company*, 31 L. J. Ex. 121. *Ibid* 480. *Barber* v. *Nottingham and Grantham Railway Company*, 33 L. J., C. P. 193.

His learned friend, Mr. Shield, had dwelt at some length upon that very important case now pending before the Courts—namely, *Angus* v. *Dalton*. The law on the points in question in that case was in a most unsatisfactory condition, as was clearly evidenced by the judgment of Lord Chief Justice Cockburn and Mr. Justice Lush, the latter judge entirely dissenting from the judgment of the Lord Chief Justice on the question of presumption. The question really at issue between those two very learned judges, was, if he might say so, whether or not the fact of assent or dissent on the part of an owner of property sought to be dominated in respect of an easement in any way affected the acquisition of that easement over his property. Mr. Justice Lush appeared to think that even the fact of the owner expressing an absolute dissent was not of the slightest importance in deciding that question. But what he (Mr. Smith) ventured to suggest at the end of his Paper had been, that there was a primary necessity for some enactment with regard to all easements, which should do exactly what Mr. Justice Lush did not appear to think necessary should be done, namely: enable every owner of property, over which any right was sought to be acquired, whether a right to

light, or a right to support, or whatever right or easement it might be sought to acquire, to record his dissent in some simple way, such as going before a District Registrar and enrolling a Deed of Protest. Many other means would suggest themselves by which the owner of property might be enabled to prevent the acquisition of right of that sort which would tend permanently to injure his property and deteriorate its value.

To pass on to the observations of Mr. CHATFEILD CLARKE. He had read that gentleman's very excellent practical suggestions in one of the professional Papers with regard to the appointment of skilled referees. In these suggestions, however, he did not entirely concur, so far as the ability of such referees to decide questions of this kind was concerned. It was, he believed, a fact that these questions when they came before the Courts of law were seldom, if ever, decided upon what might be termed conclusive evidence. There was no rule (and Mr CLARKE, he was sure, would agree with him) to guide either Courts or experts in the matter of light for instance. It was utterly impossible for the most skilled, practised, and efficient surveyor or architect to come into Court and deliberately pledge himself as to the exact value of the quantity of light lost or acquired in any particular instance, and he hardly thought that skilled referees would be any more successful in such cases than the Courts had hitherto been. Possibly Mr. CROOKES might provide a solution of the difficulty by finding means for measuring light in a mathematical and scientific manner.

He quite agreed with Mr. CLARKE that there were many questions with which it had been utterly impossible for him (Mr. SMITH) to deal in so short a Paper—such questions as those he instanced, the right of support for shoring, and points relating to party-walls, footings, and so on. Within the Metropolis most of these matters were regulated by very

clear and definite rules, under the provisions of the Metropolitan Building Acts, and to discuss them would have been impossible within the limits of his Paper. As the PRESIDENT and Mr. CLARKE would see, he had carefully avoided all mention of Building Acts, otherwise he knew the endless controversy that would ensue from the conflicting views as to the necessary provisions of such Acts.

Attention was drawn by Mr. RYDE to the fact, in connection with the respective rights of ownership in the surface and in the minerals, that there was a general presumption that they were originally in the hands of the same owner, and therefore that, when any decision had to be come to with regard to the relative rights of the owner of the surface and the owner of the minerals, we should, as it were, go back to the period when the surface and the minerals became separated, and discover, if possible, either from documentary, or from whatever other evidence there might be, the respective rights of the parties; and if a mining owner could show, either by documentary evidence of the original terms of the severance, or by express agreement, or by statute, or by notorious usage, that certain rights existed so long and so uninterruptedly as to leave no doubt as to their exercise, the law would support and uphold those rights. There was, however, a great distinction between the exercise of rights in minerals under waste land and the exercise of rights in minerals in other lands by the lord of the manor. In the first instance (namely the exercise of those rights under waste lands), the lord of the manor had the property and the possession both of the surface and of the minerals, and of course it was natural to suppose that the law would construe his rights in a larger and more liberal manner than it would construe his rights under the lands of the customary freeholders who were possessed of the surface. That distinction ran through the whole of the

cases upon this complicated and intricate matter. He might add, with regard to some observations that had fallen from Mr. Clarke and others, that it was impossible for him in such a Paper as this to advocate principles of law upon reasons of public policy; all he had to do was to endeavour to define the law in its existing state, or as he conceived it to be. The danger or probable mischief of a legal doctrine was a question for the legislature, not for those whose duty was merely to interpret the law as they found it. It was therefore sufficient for him to say with reference to this point, what he had already said in his Paper, viz.: "A custom within the manor for the lord who is seised in fee of the mines and collieries therein to work them under any dwelling-houses, buildings, and land, parcel of the manor, doing no unnecessary damage, and paying to the tenants and occupiers of the surface of lands damaged thereby a reasonable compensation for the use of the surface of the lands, *but without making any compensation for any damage occasioned to any dwelling-house or other buildings* within or parcel of the manor," had been held to be void as being unreasonable. This case (*Hilton* v. *Lord Granville*) was not yet overruled, although its authority in some points had been considerably weakened. The House of Lords, for instance, in *Robotham* v. *Wilson*, had refused to give its sanction to a dictum, insisted on in *Hilton* v. *Lord Granville*, "That a *deed* containing a stipulation to let down the surface was unreasonable and void." He was, moreover, bound to admit that the tendency of the recent decisions had been, as it appeared to him, to give a greater latitude to the rights of the lord of the manor in respect of the working of minerals; but he only stated the law as it was to-day, and, as his learned friend, Mr. Wheeler, had said, it might probably be different next week or next month. In conclusion, he begged to thank the Members for the courteous manner in which his Paper had been received.

The President said that at that late period of the evening he should occupy the shortest possible time in delivering the vote of thanks, in which all had most cordially concurred, to Mr. Smalman Smith for his admirable Paper. It had put before them the salient points of this wide subject. If the learned Author had entered into all the details, not one, but many evenings would have been required to exhaust them. The few observations that he proposed to offer would be on a point which had hardly been referred to in the discussion, and that was as to the exercise of Imperial mining powers over the estates of ordinary freeholders. The only cases, he thought, in England at the present time were those of the Duchy of Cornwall in Cornwall, and of the Duchy of Lancaster in the King's Field in Derbyshire. Those were the only two cases in which any person, making application to search for ore and having authority from the Duchy, has conferred on him the power of entering any estate and taking out of it, within a certain area, ore without any compensation at all to the freeholder. In the Forest of Dean, he thought that, if any one took that power from the Crown, they had to give the surface owner some compensation. It was undoubtedly to the interest of the public to assist in giving the most extensive powers to enable the extraction of tin, copper, lead, coal, and other minerals. If extensive powers did not exist, vast areas of coal, iron-stone, and other ore must be for ever unproductive. In the case which had come before them more than once that evening, the Duke of Buccleuch had an extensive mine of hematite ore, and under the decision, given on general principles, the Duke was unable *on any terms* to utilise that ore. If the owner of the surface saw fit to utterly refuse to enter into any kind of compromise, that hematite must continue for ever unproductive of industry. Yet hematite was the foundation of our iron industry at the present instant; for there was scarcely any iron made in any part of England

which had not mixed with it some portion of hematite. If we had not hematite, a great part of our iron industry would go to other countries. The State, therefore, had the highest interest that the hematite on every one of the properties where it may be found should be freely used; and yet under this decision any person who chanced to be the owner, not of the iron ore but of the surface above it, was able to say: "The iron industries may be destroyed for aught I care, but that hematite shall never be used."

This power had, to a considerable extent, its origin in a legal doctrine (which had gradually grown up, which appeared in the course of this Paper, and always appeared in every discussion on iron-stone, or coal, or any other mineral) that mineral rights must be regarded as subservient to the ownership of the surface, and the mineral owner be regarded as possessing a property of an inferior nature to that possessed by the surface owner. Undoubtedly, that general view had been acted upon for the past one hundred years, and was at the present time somewhat less narrow than it used to be. The origin of this view seemed to be, that in earlier times the ownership of the surface was really the ownership of everything that possessed value in an estate. Few or no cases in the Courts came from the mineral districts, which were either Counties Palatine or had Duchy Courts, and in other cases the income from the surface was all that was derivable from property. "*Cujus est solum, ejus ad inferos,*" was right enough in the southern counties, and many a southern judge must have sat upon the bench for years without ever having a mineral case to consider. Therefore it became customary to regard the minerals as subservient to the surface.

But this case showed how ill this view applied at the present hour. The hematite, made so subservient to the

surface as to be unattainable without the consent of the owner of the surface, was probably worth £600 an acre, and the surface of the land was worth probably £30 an acre, and yet the owner of the surface, having such an inferior proportion of the whole value of the corpus, was legally able to control and keep shut up hematite of the value of £600 on each acre. He (the PRESIDENT) was desirous that this consideration should not be altogether omitted, and, as it had not been touched upon in the previous discussion, he had ventured himself to imperfectly place it before them. As to all other points he was sure that the Members had obtained a great deal of information from Mr. SMALMAN SMITH's Paper, and that they were all exceedingly obliged to him for having been so good as to give it.

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## METROPOLIS MANAGEMENT AND BUILDING ACTS AMENDMENT BILL, 1878.

Mr. A. GARRARD (Associate) said that before the Meeting broke up he thought it important to bring under the notice of the Members a Bill which had been introduced into Parliament by the Metropolitan Board of Works, entitled, "A Bill to amend 'The Metropolis Management Act, 1855,' 'The Metropolitan Building Act, 1855,' and the Acts amending the same respectively." The preamble recited that, "Whereas the provisions of the several Acts now in force within the Metropolis are insufficient for duly regulating the erection and extension of houses and buildings in close proximity to roads, passages, and ways, and it is expedient for such purpose further and better provisions should be made;" and, after certain sections relating to the regulation of buildings devoted to purposes of public entertainment,

went on to say, that, "Whereas it is expedient to make provisions with respect to the making, filling up, and preparation of the foundations and sites of houses and buildings to be erected within the Metropolis, and with respect of the quality of the substances to be used in the construction of such houses and buildings, with a view to stability of the same, the prevention of fires, and for purposes of health;" and that "it is expedient to make further and better provisions with respect to the payment of expenses, incurred by the Board in relation to dangerous structures." The portion of the Bill, however, to which he particularly wished to call attention, was Clause 4, which was as follows:—

"From and after the passing of this Act no house or building begun to be constructed after the passing of this Act shall be constructed or begun to be constructed, and no house or building shall be extended or begun to be extended, in such manner that the external wall or front of any such house or building, or if there be a forecourt, or other space left in front of any such house or building, the external fence or boundary of such forecourt or other space, shall be at a distance less than the prescribed distance from the centre of the roadway of any road, passage, or way, whether a thoroughfare or not, being a highway, without the consent in writing of the Board."

The term, "the centre of the roadway," was defined in the Bill as meaning "the centre of the space open for traffic, that is to say, the roadway and the footway or foot-path, footways or footpaths (if any), adjacent thereto;" and the term, "prescribed distance," as "20 feet from the centre of the roadway where such roadway is used for the purposes of carriage traffic, and 10 feet from the centre of a roadway where such roadway is used for the purpose of foot traffic only."

The effect of this part of the Bill, if it became law, would be, that, where any street existed for carriage traffic, no house or building could be erected at a less distance than 20 feet from the centre of the existing roadway; and, if there be a footway by the side, it must be 10 feet from the centre of that footway. Consequently, if the Bill passed, owners might in many instances be compelled to give up some 10 or 12 feet of land along the entire front of the road, and 8 feet by the side of foot passages, without compensation. The Bill then proceeded to deal, in a similar way, with buildings adjoining roads which were not public carriage-ways, the promoters seeking power, in the event of such roads or footways hereafter becoming highways, to cause the removal of such houses to the "prescribed distance," and seeking further powers for the infliction of penalties in the event of such regulations not being complied with. The Board also sought powers to make such bye-laws as they thought fit for the construction of buildings, and to enforce penalties for non-compliance. A power of appeal was given, but it was to the Board itself.

The powers sought for the recovery of penalties were exceptional, for, in the event of the proceeds of the sale of any building dealt with under the 74th Section of "The Metropolitan Building Act, 1855," not being sufficient to repay the Board the expenses incurred by them in respect of such structure, they sought power to sell the fee simple in the estate, and give a proper title to any purchaser. It would, he thought, be a very serious thing for those interested in property in London, if no steps were taken, in connection with this Bill, to protect the interests of owners; and he ventured to think the matter was such as the Institution should take up. Perhaps the best course, if the Council saw fit, was to appoint a Committee to examine the Bill, and report what steps should be taken to procure the

modification or abandonment of some of the most objectionable clauses.

The President said that the matter had already been considered by the Council, and a Committee had been appointed to examine and report on the Bill.

The Meeting then adjourned.

*Plan further illustrating Mr Thos Smith-Woolley's remarks Vol X page 75 and shewing the more recent Inclosures at Sutton Wash.*

# SUTTON WASH

## PLAN OF THE

MARSHES, BARE SANDS, CHANNEL & LANDS

Lying between

## KINDERLEY'S CUT AND THE SEA.

ABOUT THE YEAR 1800.

*And shewing the various Inclosures effected since that period.*

TYDD

THE NENE OUTFALL CUT

SUTTON BRIDGE

EMBANKMENT MADE ABOUT 1830 AND ROAD

Sands

Grass Marsh

Sands

Inclosure 1836 1400 . 0 . 0

Grass Marsh

Sands

Inclosure 1862 703a. 0r. 0p

Inclosure 1867 439a. 0r. 0p

Bare Sands

Inclosure Grass Marsh 1847 182a. 0r. 0p

Sands

Inclosure 1869 316a. 0r. 0p

Samphire Marsh

Grass Marsh

Inclosure 1873 140a. 0r. 0p

3 Inclosures 1858 1859 1860 Grass 75a. 0r. 0p Marsh

Samphire Marsh

Lighthouses

Sands

Sands

Sands

Sands

The Northern Boundary Line of the Marshes, Sands & Channel to be Embanked under the New Outfall Act

*Scale of Chains.*

0 20 40 60 80 100 200

NOTE.

Grass Marsh shewn thus

Samphire Marsh ..... "

Sands ..... "

Boundaries of Inclosures .....

C F Kell Lith. 8 Castle St. Holborn. E.C.

No. 73.]

# COUNTY BOARDS.

By C. N. BAZALGETTE (Associate).

*Read at the Ordinary General Meeting of the* Institution of Surveyors, *February 25th*, 1878.

THE PRESIDENT IN THE CHAIR.

It would appear to be almost an axiom, that, as civilisation progresses and population increases, so does the governing machinery become more complicated and intricate. And herein, perhaps, lies the true explanation of the present confusion which is characteristic of the local government of the country. Various wants have from time to time arisen, and some temporary means of meeting them have been devised and adopted, the result being the production of a machine which is incongruous in its parts, and cumbrous in its operation. The same process has frequently occurred in the making of the law. New laws are passed, as occasion requires, to provide for special wants, until such a mass of heterogeneous legislation is accumulated that codification becomes an absolute necessity. No better example of this can be taken than the numerous Sanitary Acts, which were at length reduced to something like a consistent application by "The Public Health Act, 1875." Thus, the local government of the country, having grown by a similar process of development, now requires codification. Little by little the fabric has risen, various styles of architecture have been introduced, and different principles of construction adopted, so that at last the completed work presents neither unanimity

of design, nor uniformity of execution. To use the language of Mr. Goschen, the present system has become "a chaos of rates, a chaos of values, and a chaos of areas."

The existence of the evil is now pretty generally admitted; and the best proof of this may be found in the Government Bill of the present session, which is intended to provide a remedy. But, in order to ascertain whether the Bill is wide enough in its scope and intention, it becomes necessary, as a preliminary step, that the extent of the evil should be sufficiently ascertained.

First, then, it is proposed to consider briefly the present state and constitution of local government in England and Wales, with reference to its constituent parts; and this can only be done by the examination of facts and figures. These materials have been freely taken from two most valuable and able memoranda, compiled under the direction of Mr. Wm. Rathbone, M.P., and Mr. Sam. Whitbread, M.P., whose interest in this great question has been shown by the active part which they have taken in the promotion of its settlement. To the courtesy of Mr. Rathbone I am indebted for the memoranda referred to, which have been drawn from more than five hundred public general Acts of Parliament, from decisions of courts of law, and from numerous blue-books, and subjected to careful revision by persons of great local experience.

The units, then, of local government, and their several incidents, may be divided and described as follows:—

## I.—The Parish.

The parish now, practically, means that division which is defined for the purposes of the poor law, and must be distinguished from the old civil parish, and, in many cases, from the ecclesiastical parishes formed under the Church

Building Acts. There are about 15,400 poor law parishes, of which 5,400 are townships or other fractions of civil parishes. Their average population is about 1,500, but in many cases it is under fifty persons. The boundaries of parishes never cut the boundaries of unions; for unions consist of the aggregation of parishes, and only eighty-five parishes extend into more counties than one, but the boundaries of parishes are frequently intersected by the boundaries of boroughs and Local Board districts.

The executive proper of parishes is composed of common or select vestries and overseers, and the matters which fall within direct parochial administration are very few. In some instances, the roads are managed by parochial surveyors, appointed under "The Parish Highways Act, 1835," the expenses of maintenance and repair being paid out of a separate highway rate, levied upon property liable to the poor rate, but subject to customary exemptions, and, ordinarily, not exceeding 2*s.* 6*d.* in the £. The highway parish, however, often differs from the parish as constituted for any other purpose; but there are about 6,000 single rural parishes governed by this Act, and about 40,000 miles of roads in England and North Wales are maintained at a cost of £650,000, or £16 5*s.* per mile. In some large parishes also a semi-urban organization exists, under "The Lighting and Watching Act" (3 & 4 Wm. IV., c. 90), and in many (not being within municipal boroughs) "The Elementary Education Acts," are administered by parochial School Boards, some few possessing a special administration of these matters under local Acts. The school authority of the parish, under "The Elementary Education Acts," is a School Board elected by the ratepayers, and the rate is the poor rate. The "Burial Acts," also, were originally intended to apply to the old civil parish, and a Burial Board elected by the vestry was designed to be the controlling authority, whose expenses

were to have been charged upon the poor rate. But, as matter of practice, wherever these Acts have been applied to rural places, they have generally been adopted for special districts, composed of parts of parishes, and the interment fees, when insufficient to cover expenses, have been supplemented by special rates. With these exceptions, however, the parish must be regarded merely as the constituent part of a union, and as a district for the collection of rates, and the preparation of the registers of Parliamentary and municipal voters.

## II.—The Union.

The present system of unions is the result of "The Poor Law Amendment Act, 1834" (4 and 5 Will. IV., c. 76). The number of unions in 1873 was 647, out of which 590 were wholly or partly rural. The ordinary size of a rural union is from 60 to 150 square miles, and the ordinary population from 12,000 to 20,000. In the case of urban unions the average number of persons is much greater. In the metropolis, St. Pancras contains 221,000 persons, and the average population of the thirty metropolitan unions may be taken at something over 100,000. There were, in 1873, 181 unions, which extended into two or more counties, 32 being each in three counties, and three others being each in four counties.

The executive of the union is the guardians, who consist of the justices resident in the union and of the guardians annually elected by the parishes which compose the union. The officers of the guardians consist of a clerk, a treasurer, medical officer of health, inspector of nuisances, relieving officers, workhouse officers, vaccination officer, and usually also paid valuers and collectors. The union is not a direct rating authority in the usual sense, inasmuch

as it collects its funds by precepts to the overseers of parishes, although for the purpose of the poor rate it superintends the valuation, enforces the collection, and determines the greater part of the taxation which falls upon that rate.

The duties of guardians are—

(1.) The local administration of the poor laws.

(2.) The preparation of the valuation lists on which the poor rate and most other rates are assessed.

(3.) In rural places, to act as the Sanitary Authority.

(4.) The registration of births and deaths.

(5.) The enforcement of vaccination.

(6.) The administration of the "Elementary Education Act, 1876," in places where there is no School Board, and which are not municipal boroughs.

Some of these duties include within their scope functions of the most varied and responsible character. For example, the guardians acting as the rural sanitary authority, are bound to provide for the drainage and water supply of their district, and the proper inspection and prevention of nuisances. These subsidiary functions, moreover, are liable to increase at any moment, for the Local Government Board, under sec. 276 of the Public Health Act, 1875, can invest rural sanitary authorities with all or any of the powers exerciseable by urban sanitary authorities. The effect of the operation of this power would be to throw a considerable increment of duty upon the guardians, although the words of the section are misleading, inasmuch as they convey the impression that a rural sanitary authority may in relation to any part of its district be made to stand exactly in the shoes of an urban authority. But this is not so. For example, an urban authority is *ipso facto* the surveyor of highways, while the highway authority consists of the Highway Board in rural districts, and is quite

independent of the rural sanitary authority; and yet the Local Government Board cannot, by investing the rural sanitary authority with urban powers under this section, render it the surveyor of highways, and so oust the jurisdiction of the Highway Board. The only method by which this can be effected is by the constitution of an urban authority which, as surveyors of highways, would then supplant the Highway Board. The expenses of a rural sanitary authority, when incurred for the common benefit, fall equally upon the whole rateable value of the district; but in the case of the cost of the sewerage or water supply, or of any other expenses which the Local Government Board may declare to be special, an exemption to the extent of three-fourths is allowed to agricultural lands, railways, canals, tithes, &c.

### III.—The County.

England comprises forty, and Wales twelve, counties. Every county is divided into Petty Sessional divisions, each of which may consist of any number of parishes and portions of parishes, as arranged by Quarter Sessions, and which divisions, when made, cannot be altered for a certain number of years. There are about 820 of these Petty Sessional divisions in England and Wales, which do not generally correspond with any other areas.

The executive of the county consists of the lord lieutenant, a *custos rotulorum*, a coroner or coroners, justices, a clerk of the peace, a county treasurer, surveyor, and other officers. The purposes for which this machinery exists are twofold.

(A). Imperial purposes, such as the maintenance of the Queen's peace, the militia, the local administration of justice, and Parliamentary representation.

(B). Local government purposes, such as county bridges, gaols, shire-halls, and other county buildings, police, asylums,

licensing, valuation, the application of the "District Highway Acts, 1862 and 1864," and the control, by way of appeal or otherwise, under various local Acts, of minor local authorities.

The county rate, though sometimes made the subject of a separate valuation, is usually levied upon the same valuation as the poor rate, and is made by the justices, and levied, through the guardians and the overseers, upon the various parishes comprised in the county. The committee of justices are not bound by the poor rate valuation, but may alter it for the county rate, or make a new valuation, subject to appeal to the whole Quarter Sessions.

The various objects of local government enumerated above are controlled, mediately or immediately, by Quarter Sessions. Thus, county prisons are governed by Quarter Sessions, and the expenses incident to them are paid out of the county rate, assisted by a subvention from the Treasury. The county police force is formed, as to number, and practically controlled, by Quarter Sessions, the expenses being met by a special county police rate, levied on the county police area, upon the same valuation as the county rate. Since 1875, this rate has been assisted by a subvention from the Treasury of two-fourths of the cost of pay and clothing.

Special police districts may be formed in a county by Quarter Sessions, and in such event the police rate is assessed and levied upon such special district, the expenses being divided into "general expenditure," and "local expenditure," the latter falling exclusively upon the district. The county asylums for pauper lunatics are under the jurisdiction of a committee of visitors appointed annually by the justices in Quarter Sessions out of their own body. The expenses are met (1) by a weekly charge for each lunatic which may not exceed 14*s.*, except with the consent of the majority of all

the justices, and which is charged upon the lunatic's parish, or, if he possess no local habitation, upon the county in which he was found. (2) By a special county rate upon the whole county; and (3) by contributions, according to population, from boroughs having separate Quarter Sessions, but which are not in themselves separate lunacy areas. Quarter Sessions can order "The District Highway Acts, 1862 and 1864," to apply upon an application of five justices of a proposed district; and the district itself is formed by the combination of any number of highway parishes. The executive of a district consists of a highway board composed of resident justices, and waywardens elected by the parishes, a treasurer, clerk, district surveyor, and assistant surveyor. The expenses are met partly by a common fund, and partly by the several parishes, such common fund being formed by contributions in proportion to the poor law valuations existing in such parishes. The limit of the rate is 2*s.* 6*d.* in the pound, unless four-fifths of the ratepayers consent to a further increase. There are about 400 districts, consisting of the combination of about 8,000 rural parishes under these Acts; and about 67,000 miles of roads in England and Wales are thus maintained at a cost of £940,000, or £14 a mile.

## IV.—The Borough.

There are 229 boroughs under "The Municipal Corporation Act, 1835," which vary in population from 500,000 in Liverpool to less than 3,000 in fifteen instances, and in rateable value from £3,000,000 in Liverpool to less than £10,000 in twenty-nine instances. Boroughs divide parishes, and in eleven cases cross county boundaries. Often they are non-conterminous with the Parliamentary borough of the same name, and sometimes even with the urban sanitary district

of the same name. They are generally divided into wards.

The executive of a borough is a corporation, consisting of a mayor, aldermen, and burgesses, acting by a town council, a town clerk, a treasurer, and other officers. The mayor and ex-mayor are justices of the peace for the time being, and, by virtue of a separate commission of the peace, they frequently act as county justices within the borough. Such separate commission, however, does not exempt from the county rate, nor oust the jurisdiction of the county justices, unless a separate quarter sessions, with a recordership, has been established, in which case the borough becomes exempt under sec. 112 of "The Municipal Corporations Act, 1835," from the county rate and subject to a borough rate. In any event, however, the borough has to contribute to certain county expenses. Of the total number of 229 boroughs, only 97 have quarter sessions of their own, 167 have separate police, and 35 separate prisons.

The principal functions of the executive are as follows:— To provide for the lighting and watching of the borough, under "The Municipal Corporations Act, 1835." The Watch Committee has to take care that a sufficient force of police is maintained, whose expenses are met by the borough fund or rate, or by a watch rate, and are assisted, when the police are efficient, by a contribution from the Treasury. "The County Police Act, 1840," contains provisions for a partial combination of the borough and county police.—To act as an urban sanitary authority under "The Public Health Act, 1875." An urban sanitary authority, which is a borough, improvement commissioners, or a Local Board, has to discharge many important duties in addition to those which devolve upon a rural sanitary authority. It is the highway authority within its district, and has, moreover, to regulate traffic, effect public improvements, provide for lighting, and make

bye-laws for many important purposes. The expenses fall upon the general district rate, which allows an exemption of three-fourths of their rateable value to agricultural land, railways, canals, tithes, &c.—To provide accommodation for pauper lunatics. This duty is confided to a committee of visitors, who are appointed annually by the borough justices, and the expenses are met by a weekly charge similar to that which has been referred to in the case of county asylums, and by the borough fund as a special rate.—To apply "The Elementary Education Act, 1876," in the absence of a school board. The acting authority for this purpose is a school board elected for the borough, and the rate is the borough rate. Besides these duties, the town council often acts as the burial authority for its district.

## V.—Urban and Semi-Urban Authorities and Areas.

These authorities and areas, so far as they have not been previously discussed, consist of Local Boards, under "The Public Health Act, 1875;" Improvement Act Districts, constituted under various special Acts; and Jurisdictions formed under "The Lighting and Watching Act, 1833."

(A) *Local Boards.*—There are 640 Local Boards in England and Wales. They are of all populations and sizes; and their areas often infringe the boundaries of parishes and unions. The Mossley Local Board District in Lancashire comprises parts of four poor law parishes, two unions, and three counties. The executive is the Local Board, and it discharges the duties attaching to an urban sanitary authority, under "The Public Health Act, 1875," which have been already described with sufficient detail in the case of a borough.

(B) *Improvement Act Districts.*—There are about seventy of these districts. Their executive consists of commissioners, who, under "The Public Health Act, 1875," have

become urban sanitary authorities and discharge urban sanitary duties.

(c) *Jurisdictions formed under "The Lighting and Watching Act*, 1833."—This Act has been partially adopted by about 220 parishes or parts of parishes, mostly in the southern and midland counties. The expenses are met by a rate, resembling the general district rate leviable under "The Public Health Act." These jurisdictions cease to exist in any place which becomes either an urban sanitary authority or a part of an urban sanitary authority.

The constitution of urban and rural sanitary authorities has been sufficiently explained for the purposes of this Paper; but it may be pointed out that, though the distinction in name is so marked, it is nevertheless frequently misleading when compared with the results of practice. For example, in the rural sanitary authority of the Tynemouth Union, there are nine different urban sanitary authorities, with nine different governing bodies, employing the services of 95 members of the boards. The population of these nine urban authorities is 73,000 persons, leaving to the residue of the union or rural sanitary authority a population of 22,000 persons only.

Thus, to summarise the foregoing facts and statistics as to the areas, authorities, and rates, which form the constituent elements of local self-government.

## I.—Areas.

Parishes sometimes cut counties, and often boroughs and local boards. Unions cut counties. Counties are divided into petty sessional divisions, which correspond with no other areas. Boroughs cut parishes, sometimes counties, and are often non-conterminous either with the Parliamentary borough or the urban sanitary borough. Local boards cut the boundaries of parishes, unions, and counties.

## II.—Authorities and Rates.

(A) *Highways.*—The parish is a highway authority, and levies highway rates upon the poor law valuation. The county, through the district highway board, is a highway authority, and levies highway rates upon a common fund. The borough, as an urban sanitary authority, is a highway authority, and levies highway rates upon the general district rate. Local boards are highway authorities, and their rate also is raised out of the general district rate.

(B) *Schools.*—The parish is a school authority under the Elementary Education Acts, and its rate is the poor rate. The union, through the guardians, is a school authority, and its rate is also the poor rate. The borough is a school authority, and its rate is the borough rate.

(C) *Sanitary Administration.*—The union, through the guardians, is a rural sanitary authority, often interspersed with urban sanitary authorities, and its rate is upon the poor law valuation, with certain exemptions in the case of special expenses. The borough is an urban sanitary authority, and its rate is the general district rate. Local boards are urban sanitary authorities, and their rate is the same as in the case of boroughs. Improvement commissioners are urban sanitary authorities, and their rate resembles the general district rate.

(D) *Legal Administration.*—The county applies the law through Petty and Quarter Sessions, and the rate is the county rate. The borough administers the law by virtue of separate commissions to Courts of Record, and the rate is the borough rate.

(E) *Police.*—The county is a police authority, and the rate is a special county police rate. The borough is a police authority, and the rate is the borough or watch rate.

(F) *Lunatic Asylums.*—The county provides lunatic

asylums by weekly, parochial, or county charges, by special county rates, or by contributions. The borough provides lunatic asylums by weekly charges, the borough fund, or special rates.

The above description of the various units of local government cannot pretend, on account of its necessary brevity, to be either a complete or exhaustive summary. Nevertheless, it is submitted that it is sufficient to establish with overwhelming force the necessity of some simplification and reform of their intricate and conflicting operation. There is, it is true, some machinery which has been provided for blending and fusing these heterogeneous materials, but its insufficiency is manifest. For example "The Poor Law Amendment Acts of 1834, 1844, and 1876" contain powers for the dissolution of unions, the addition or abstraction of parishes, and the separation and amalgamation of isolated or detached portions of parishes for poor law purposes. "The Public Health Act, 1875," also contains provisions for the alteration of areas and union of districts for sanitary purposes.

Having then sufficiently described the nature and extent of the evil, a proper judgment can be formed as to the adequacy of the remedy which the Government, by their Bill, have sought to provide. This Bill was brought in, and ordered by the House to be printed, upon the 28th of January last, and its short title is, "The County Administration Act, 1878." Part I. relates to the administration of county business, and, by clauses 3 and 4, coupled with clauses 31 and 32 (part III.), the Bill provides for the constitution and jurisdiction of County Boards. The scheme upon which these County Boards are to be constructed may be shortly stated as follows:—Quarter Sessions is to remain *in statu quo* for purposes of justice, prisons, and police; but for all other purposes is to be re-constituted as a County Board.

Such County Board is to consist of two justices from every petty sessional division, to be chosen by the justices of the county; and two elective members, to be elected by the elective guardians, out of their own class, or of those who possess the necessary qualifications to be elective guardians. The members of the Board are to retire annually, subject to their right to offer themselves for re-election.

Now, much of the discussion which has been provoked by the Bill has been directed to the area of representation and the constitution of the authority which is proposed by these clauses. First, as regards the area of representation, which, as already mentioned, is to be the petty-sessional division. Mr. Sclater-Booth, in moving the second reading of the Bill, stated at some length the reasons which induced the Government to adopt this area as the unit of representation; and these reasons may be thus briefly expressed.

Having approached the subject with a partiality for the union as the proper unit, he found that its adoption involved almost insuperable difficulties. The union in so many instances overlapped county boundaries, that, in providing for the election of a County Board, special arrangement would have to be made, for the discharge of their duties, by the guardians of parishes. To bring unions within the boundaries of counties would be practically impossible in the present state of poor law administration, and the overlapping portion would have to be represented on the County Board. Unions also often comprise quarter session boroughs, which are omitted from the operation of the Bill, and petty sessional areas never include quarter session boroughs. The petty sessional divisions, moreover, combine into a complete county, and the centre of each division would be a convenient place to meet, while the clerk to the justices might act as a returning officer at the election. The objection of the in-

equality of population in these petty sessional divisions was immaterial, so long as the county was fairly represented. Out of 750 divisions only about 50 contained a population of less than 10,000, and, of these, 21 contained a population of between 10,000 and 6,000, and 33 a population of less than 6,000. Another advantage attaching to the above petty sessional divisions consisted in the fact, that they had no separate ruling powers or separate interests to make them rivals.

The objections which have been urged against the petty sessional division, and the reasons which have been urged in support of the adoption of the union, as the unit of representation, appears to be as follows:—

That the introduction of a new electoral area is, in fact, to make an addition to the present multiplicity of areas, instead of reducing them to a more compact form.

That the union is the recognized administrative area, and its presiding authority is the guardians, who are to be called upon to elect representatives from a different area, which constitutes a serious anomaly.

That the unit of representation should be based upon community of interest, and that, though poor relief, highways, sanitary matters, and education are common to the union, they are none of them common to the petty sessional area.

Mr. Rathbone, dealing with the objection to unions on account of the inequality of their population, has pointed out that this inequality prevails to a far greater extent in the case of petty sessional areas, and that there is all the difference in the world "between the continuance of old existing anomalies and the creation of anomalies that are entirely new." By some, it is further maintained that the rectification of the boundaries of the union, to bring them within counties, would not be so difficult a task as is

generally assumed, for, though 181 unions cross county boundaries, yet, in a very large proportion of these cases, they only cross to the extent of two or three parishes. One important question, therefore, for the consideration of the Institution, in the face of these diverse opinions, is whether the petty sessional division or the union affords the best electoral unit.

The next point which invites attention is the constitution of the proposed County Board. Upon this, it must be observed, that it is a complete fallacy to imagine that the principle of direct representation, which has often been suggested as a vital element in the formation of the Board, has had any practical effect given to it by the Bill. The governing Board is, in fact, to be composed of justices chosen by justices and guardians, the former holding office by the nomination of the lord lieutenant of the county, and the latter by the election of the owners and ratepayers of the parish. Thus, the only element of representation is that which, passing from the ratepayers, is filtered through the guardians to the County Board.

Again, is it certain that when the constitution of the Board has been accomplished it will be the best administrative body which can be secured? There is a direct conflict of view upon this point. On the one hand it is maintained that the new constitution will contain within it the elements of strife and discord. Thus it is urged that according to the Bill there will be an equal proportion of justices and guardians from the petty sessional divisions, and it is alleged that these classes are more or less antagonistic in their character. Of course, there are exceptions to every rule; but it is said that while the justice as a rule represents the landowner and country gentleman, the guardian represents the farmer and county tradesman. The justice is presumed to take a broader view of the expediency of

things, and to be more willing to submit to a temporary sacrifice for the purpose of obtaining a permanent benefit; while the latter is presumed to regard matters more from a local and personal standpoint, and to look with hereditary abhorrence on anything which savours of a temporary increase in the amount of his taxation. Then it is said that these classes will be frequently opposed to each other upon the Board, and that the additional element of members from boroughs, who, being of a similar class and temper, and, therefore, more sympathetic with the guardians than with the justices, will give the guardians a majority whenever they wish to defeat the justices. This new element is introduced by a clause of the Bill which provides that every borough which is wholly situate within a county with a separate Commission of the Peace, but not a separate Court of Quarter Sessions, and which has a population of 20,000 persons, is to appoint four members to the County Board; and so it is affirmed by way of conclusion that the justices, finding themselves habitually outvoted, and that no practical result is achieved by their presence at the Board, except their own inconvenience and discomfiture, will cease to come to the Board, or take any part in the transaction of its business. It is further asserted by those who take this pessimist view that the consequence of Clause 6, which enables the Board to appoint administrative Committees, will be, that the majority will place their own members upon them, and that the justices will be effectively ousted from any participation in the management of county affairs. Moreover, that Quarter Sessions has hitherto conducted the affairs of the county efficiently, and that there is absolutely no guarantee that, in transferring the business to County Boards, an inferior organisation will not be substituted. On the other hand, it is submitted that the guardians, as a general rule, are the best specimens of their class, and are as willing

and able to look to the general interests of the community as the justices; that the class distinction between them and the justices is faintly marked; and that the office of guardian and justice frequently meet in the same individual. Consequently, there can be no real meaning in the alarmist opinion that there will be a conflict at the Board resulting to the prejudice of the justices. Further, upon this point of representation, that all representation must be limited in proportion to the capacity of the electors to understand the questions which are to be brought before the administrative body, and that if this principle were departed from, and if for example, in matters of state, an universal suffrage were introduced, the practical effect would be to substitute mob rule for a more select and enlightened system of government. So, too, if the election to County Boards were vested directly in the hands of the ratepayers, the effect would be that the most popular and not the most efficient man would be found upon the Board.

The principal arguments against the constitution of the County Boards proposed by the Bill, may be thus shortly summarised—(1) They introduce a new area of representation; (2) They are in no sense based on the principle of direct representation; (3) That the transfer of county business from Quarter Sessions to County Boards will result in a much worse administration than at present exists.

To these points it is suggested that the discussion upon this Paper should be specially directed. Part II. of the Bill defines the new powers of the County Board. First, it is provided, in relation to main roads, that highway districts and highway parishes shall be contributory places for the purposes of maintenance and repair, and that the cost in certain cases shall fall partly upon the county and partly upon the local authority, and be defrayed out of the county road fund, as provided by sec. 16, to be raised upon the

contributory places, according to the valuation list in force for the time being. This is, no doubt, a salutary provision as far as it goes; but it must be borne in mind that urban sanitary authorities are still left as independent highway authorities, and that uniformity of jurisdiction in this respect is in no wise obtained by the Bill. Further, the power given to the County Board, by sec. 16, to erect toll-gates and levy tolls, is one which the public would bear with impatience. To meet this difficulty, it has been suggested that the local authorities should have power given them to impose a wheel tax of their own. Clause 21 enables the County Board to enforce the performance of its duty by a defaulting highway authority. Clause 22 empowers the County Board to enforce "The Rivers Pollution Act, 1876;" but it is submitted that, having regard to the numerous authorities and individuals who already possess a statutory right to put that Act in motion, this provision would seem to be rather a multiplication than a simplification of jurisdictions. County Boards, moreover, under Clause 23, may become Conservancy Boards. This may be a useful provision, but it seems to be framed upon an erroneous principle, for it is submitted that drainage and conservancy boards and authorities should, as far as possible, be made coincident with each other, and that the only true area must be the watershed, and the only real authority a watershed board. Besides, it may be remarked that the provision is merely the invention of a new power, and is in no sense a measure of Local Government reform, for reform implies an amendment of existing machinery. Clause 24 enables County Boards to prepare schemes for the sanction and approval of the Local Government Board, providing asylums and schools for imbecile and pauper children; and the County Boards of two or more counties may combine for that purpose.

This again is a new power, and though it may, no doubt, be required as a provision for an existing need, yet it cannot be regarded as an amendment of an existing provision of local government. Clause 25, under the head of "adjustment of areas," is one of the most important provisions in the whole Bill. It is aimed especially at the present confusion of areas; but, except that it vests existing powers of adjustment in one central authority, it does nothing to increase the facilities for reducing chaos to order. It, in fact, improves the administration of these powers without any further addition to them. All that, in fact, it accomplishes is to vest in the County Board the powers already contained in "The Poor Law Amendment Acts of 1834, 1844, and 1876" for the dissolution, increase, and reduction of unions and parishes, and in "The Public Health Act, 1875," for the amalgamation and alteration of sanitary areas.

The remainder of the Bill is comparatively unimportant, so far as any substantial reform of the present system of local government is concerned. It enables County Boards to appoint coroners, and to exercise borrowing powers; contains regulations for the issue of provisional orders; and, in clause 42, there are some special provisions as to certain parishes, which become important when considered with the general scheme provided by the Bill.

The impression left upon the mind on consideration of the Bill is somewhat disappointing, for, while the evil is undeniably radical, the remedy is undoubtedly tame. It may be a step in the right direction, though even this is not clear; but, assuming this, it is a very timid one. The view which was shadowed forth at the Central Chambers of Agriculture—and it is mainly to the efforts of these Chambers that the present attempt at legislative reform must be ascribed—was of a far bolder and more extended character.

In fact, the scheme suggested by Captain Craigie, who has worked up this most difficult subject, was expressed in these words,—"We might bring our poor law, sanitary and highway duties, within one area, and administer them by one authority." It has been already stated that, according to my view, the sanitary area should, for purposes of drainage, be adjusted according to the watershed; but, apart even from this consideration, the present Bill does not go to anything like the extent proposed above. There is time yet for the re-consideration and re-construction of the Bill; and it is hoped that the discussion upon this Paper may result in the suggestion of amendments, which may assist to make it a more complete and satisfactory measure.

Mr. D. Watney (Member) had much pleasure in proposing a vote of thanks to Mr. Bazalgette for his very able Paper. He felt that it would be impossible to discuss so technical a Paper without a careful perusal, and should therefore move the adjournment of the discussion until the next Meeting.

Mr. V. Buckland (Member) seconded the vote of thanks, which was carried unanimously, and the adjournment of the discussion was agreed to.

The President said that the Paper had been listened to with the greatest possible interest. The first part of it gave a sort of summary of the existing management of agricultural districts, and the rest indicated the mode in which a certain portion of the county business was to be conducted in the future. In a measure of so extensive a kind, much might be open to improvement in its consideration in Parliament. So far as he had been able to gather, there seemed to be an impression in favour of the Bill, as compared

with other suggestions; but further discussion was required, and would certainly take place. It was clear that some Act would be passed as soon as possible.

Mr. E. Ryde (Vice-President) proposed, with the permission of the Meeting, to read some notes which he had prepared on the Rating of the Worcester Water-works. This case had been carried to the highest Court of Appeal, and involved principles materially affecting the interests of the public, which demand that all incidence of taxation shall be most rigidly examined.

He proposed to state the facts, accompanied by such comments only as were indispensable to indicate the points which called for discussion at the hands of the Members.

No. 74.]

# NOTES ON THE RATING OF THE WORCESTER WATER-WORKS.

By E. RYDE (Vice-President).

*Read at the Ordinary General Meeting of the* Institution of Surveyors, *February 25th*, 1878.

THE PRESIDENT IN THE CHAIR.

1. The Mayor, Aldermen, and Citizens of the City of Worcester, who, being the Council of that city, are the Local Board of Health and Urban Sanitary Authority for it, appealed to Quarter Sessions against poor rates based on a Valuation List dated 22nd October, 1873. On the 17th December, 1873, they gave notice of objection and appeal to the Assessment Committee against the Valuation List, the principal and main ground of objection being that they were over-assessed in respect of the water works and land occupied by them in the parish of Claines. The Committee confirmed the assessment.

2. The assessments upon these water-works, previous to 1873, had been as follows, viz.:—

| | | Gross. | Rateable. |
|---|---|---|---|
| In 1869. | Reservoir water-works, &c. | £460 0 | £414 |
| | Land . . . . | 22 10 | 22 |
| | | £482 10 | £436 |
| By a supplemental Valuation List, dated 13th June, 1870, reservoir, water-works, main, &c., were rated at . . . . . | | £600 | £540 |

| | Gross. | Rateable. |
|---|---|---|
| By another supplemental Valuation List, dated 22nd October, 1873 (the one in dispute), water-works and land were rated at . . | £1,750 | £1,400 |

3. The water-works were first erected in 1856 upon land containing 2 acres 1 rood 4 perches at Barbourne, and 1 acre 33 perches at Rainbow Hill in the parish of Claines. Including a reservoir and mains and pipes in the city of Worcester, and including also £2,076 paid for land, the total cost of the water-works was £30,000.

4. In 1866, the water-works were enlarged. Additional land to the extent of 5 acres 1 rood 22 perches was purchased at Barbourne in the parish of Claines, and, including about £2,300 paid for the land, the total cost of the enlargement was £18,000. This sum of £18,000 and the former sum of £30,000 were raised by mortgage of the General District Rates of Worcester, repayable by annual instalments during a period of 30 years.

5. The interest and instalments of principal payable in the year ending 31st August, 1873, amounted to £2,976. On a four per cent. table the annual amount required for the repayment of a loan of £48,000 with interest by equal annual payments, is £2,776, of which £1,920 is interest and £856 instalment of principal.

6. Out of the total sum of £48,000, as much as £37,250 was spent in the parish of Claines, and 4 per cent. interest upon that sum amounts to £1,490.

7. The Local Board constructed their works under the powers of "The Public Health Act, 1848." They raised the money under the powers of that Act, and levied upon the consumers of water a water rate under the powers of that Act.

8. The amount of the water rate appears to have been

fixed, as long ago as the 2nd March, 1858, at 4*d.* in the pound on the net annual value of the houses and premises supplied with water for domestic use, cleanliness, and drainage, and an additional charge for water used for trade and other purposes, and also a certain scale for water supplied by meter.

For houses of less annual value than £8 they only charged two-thirds of the rate. The effect of this rate is to charge a house of £20 per annum a water rate of 6*s.* 8*d.*, and a house of £8 a water rate of 1*s.* 9*d.* per annum.

There is a scale of charges for trade purposes—viz., fishmongers 10*s.* per annum, greengrocers 4*s.*, washerwomen 4*s.*, and so on.

For water supplied by meter the charges are about 3*d.* per thousand gallons.

The Local Board fixed these low scales of charges, not in order that they might make a profit out of the water as a commercial enterprise, but in order that the supply might be brought within reach of the poorest inhabitant and that the health of the city might be promoted thereby.

9. At the hearing of the appeal, the Local Board contended that, as it appeared from their published accounts that the whole net income derived from the said water-works, during the eight years previous to the appeal, averaged only £651 per annum, without any deduction having been made for rates, taxes, expenses of management, collection of water rate, depreciation of plant and machinery, and other matters which, in making out a commercial account, would have been allowed for, the assessment should be reduced to £600 gross estimated rental, and £540 rateable value.

In stating the case for the opinion of the Court, the appellants contended that the provisions of "The Public Health Act" contain the only authority for the appellants to charge a water rate on consumers of water, and that such

a rate only is authorized by the statute as might be reasonably expected to be necessary to defray the expenses incident to the water supply, and that they have no authority, by the Act or otherwise, to receive any more money from the consumers than is required to pay the above-named expenses. And further, that as the inhabitants have, on the faith of the existing rates, adopted the water supply of the appellants and suffered their private resources to fall into disuse, without special causes it would be a breach of good faith to alter such rate, and that therefore the appellants are only rateable for the rent which a tenant from year to year could give for the land, subject to the existing rates and the same restrictions (if any) as those under which the appellants held it, and not that which a tenant entirely unfettered might give.

10. The respondents contended that it is right to rate the appellants, in respect of the water works in Claines, at what a tenant would give with liberty to raise the price of water as he might think proper, so far as not restricted by law; that there were no restrictions by law in the present case; and that the fact that the appellants, in fixing their rates, looked only to the benefit of the inhabitants and ratepayers of the City of Worcester only transfers the advantage and benefit of the property from themselves to those inhabitants and ratepayers from whom they are trustees; and that it would be unfair that the inhabitants and ratepayers of the City of Worcester should enjoy this advantage and benefit at the expense of the parish of Claines and the rest of the Droitwich Union.

11. If the Court were of opinion that the contention of the appellants was right, the rate was to be amended, and so much of the said valuation list as referred to the land and works in question was to be cancelled, and the income that the appellants had actually received for the same was to be

taken as the fair annual value thereof, and the assessment was to stand at £600 gross estimated rental, and £540 rateable value.

12. If the Court were of opinion that the contention of the respondents was right, then the assessment of £1,750 gross estimated rental, and £1,400 rateable value, was to stand.

13. On February 11th, 1876, Mr. Baron Cleasby delivered judgment, as reported, in the following terms :—

" The question, in this case, is not the rateability of a " public body in respect of premises occupied by them for " public purposes. That question has been for some time " settled; and it is not disputed that the appellants, who " are the Local Board of Health of Worcester, are liable to " be rated in respect of water-works erected and occupied by " them, for the purpose of supplying the inhabitants with " water. The question is, whether the rateable occupation " is to be measured by the profits actually derived from the " occupation, or by the profits which might be derived from " it by a person or a company who occupied the works " solely for the purpose of profit; the fact being, that the " Corporation having in view the benefit of the inhabitants, " have made the scale of rates so low as to leave a profit " only of £600 upon the rates actually received, after " deducting the expenses connected with the providing the " water, collections, &c., upon which amount they contend " they ought to be rated ; whereas, the respondents contend " that a trading company, with the same powers of rating, " might have realised a net profit of £1,400, on which " amount, they say, the rate ought to have been made. It " seems to us that the respondents cannot maintain the rate " which they contend for; and that the restrictions which " are put by law upon a public body, as to the profits " derivable from the occupation of water-works, or gas

" works, or other property of that description, must be " regarded in considering the profitable occupation by that " body. For example, if the Local Board was prohibited " from charging more than 2*d.* a week on a dwelling-house; " and the water-works were so complete, and the demand so " great, that a private trading company would be able to " charge 6*d.* a house, we should feel no doubt whatever that " the Local Board, whose duty it was not to let to a trading " company, but themselves to occupy, could only be rated " upon the occupation, and the rate which they were com- " pelled to charge. This is not the present case, but only " an illustration of a restriction put by law upon the value of " the occupation; and the effect of it could not be disputed, and " indeed was hardly disputed in the course of the argument. " The hypothetical tenant, who is subject to no restriction, " cannot represent the real occupier, who is by law subject " to restrictions. This conclusion would be well supported by " the cases of *The Queen* v. *The Metropolitan Board of* " *Works*, and *The Metropolitan Board of Works* v. *The* " *Overseers of West Ham*; and is fairly borne out by the " opinion of WIGHTMAN, J., and COMPTON, J., in *The Queen* " v. *Longwood*. We were also referred during the ar- " gument to another case, *The Mayor of Liverpool* v. *The* " *Overseers of Wavertree*, and it may be said to have " been there expressly so decided. The only question, " therefore, is whether a public body, exercising their " powers properly, for the benefit of the inhabitants, and " making their rates *bonâ fide* for that purpose, and so regu- " lating their conduct by the restriction, as it may be called, " of acting in obedience to the Act of Parliament, can be " properly represented, for the purpose of rating, by a " hypothetical tenant acting under no such restriction. We " are of opinion that they cannot. They only acquired the " right to the rates by the Act of Parliament, for the

"purpose of carrying the objects of 'The Public Health Act
"properly into effect; and the profitable occupation, which
"they in fact have, is the only one which they can properly
"have; and it would be strange to rate them, not in respect
"of what they can properly enjoy and do enjoy, but
"in respect of what they cannot properly enjoy, and
"do not enjoy. We adopt the language of LUSH, J., in the
"before cited case of *The Metropolitan Board of Works* v.
"*The Overseers of West Ham*, that the proper mode of
"estimating the profitable occupation is to take it as it
"actually is. No distinction was attempted to be made
"between the money derivable from the rates, properly so
"called, and that derived from agreements with traders and
"manufacturers. The question above discussed was the
"only one argued before us. For the reasons above given
"we think that the contention of the appellants is right,
"and that, as the sum of £600 properly represents the value
"of profits actually had, the gross estimated rental ought
"to be reduced to that sum, and the rateable value
"to £540."

14. This being the judgment of the Court, it becomes the law which is to govern Surveyors, so long as it remains unaffected and unaltered by future judgments. It is, therefore, necessary to examine it, with a view to its application to other cases. A close investigation of the case will show that, however the inhabitants of Worcester may persuade themselves that they are drinking cheap water—that is, water cheaper than could be supplied by a trading company,—the facts are, that the cost at which they do actually get this water would be quite sufficient remuneration for a trading company.

It is not suggested that it is an improper proceeding for a Local Board to supply its inhabitants with water. All that is suggested is, that the sum of £856, explained in para-

graph 6, would be sufficient to meet all the charges which a trading company would make, but which the Corporation do not make, and that the Corporation do, therefore, raise sufficient money, under their restrictions, to render a comparison between the cost of the two systems possible, and not unfavourable to the trading company.

The first cost to the inhabitants is the annual payment of £2,976, in respect of interest and instalments of principal, in connection with the money borrowed for the original construction of the works.

The next, is the expenses which are incident to the water supply. There is also the expense of collecting the water rates, and there are the payments for rates and taxes. The latter are small items, which do not appear to have been charged to the water-works, in making up the figures for the case which was submitted to the Court.

It does not quite appear, from the case, how this actual cost to the inhabitants is met.

It is stated that the net income derived from the water-works has averaged £651 per annum. This statement may mean that the water rates have defrayed the total cost, including the payment of £2,976, and left £651 surplus, or it may, and probably does, mean that the water rates have been sufficient to pay the expenses incident to the water supply, and have left that amount of surplus or profit. It is quite immaterial, for the present purpose, whichever may have been the fact. If the former supposition be correct, the water rates have paid the sums which are equivalent to the following outgoings of an ordinary water company, viz:—

(1) Working Expenses.
(2) Rates and Taxes.
(3) Rent.
(4) A Sinking Fund to reproduce the property in 30 years.

If the latter, then they have paid—

(1) Working Expenses.

(2) Rates and Taxes.

But the £2,976 a year, the equivalent of rent and sinking fund, has been paid out of the general district rate of the borough, which is equally a charge on the inhabitants, with this difference only—viz., that it is contributed to as well by those who have not used the water as by those who have. In neither case could the sum of £651 be any index to the rateable value of these works. It would, in fact, be a profit derived from the sale of water after defraying the expenses incident upon the delivery of that water, and in no sense rateable, because water, *per se*, is not a rateable hereditament.

The rateable hereditament in this case is the water-works, and the rateable value is the rental value of those works. These principles are not affected by the considerations referred to in the judgment concerning restrictions of price charged for the water. Those restrictions only affect the amount of the rent, not the nature of the hereditaments; and so long as the calculations are confined within the limits of the actual receipts and payments of the Corporation, received and made under those restrictions, controversy on that head cannot arise.

That portion of this judgment which directs that "a "public body, exercising their powers and regulating their "conduct by the restriction," as it is therein called, "of "acting in obedience to the Act of Parliament, cannot be "properly represented for the purpose of rating by a "hypothetical tenant acting under no restriction," is a two-edged sword, for, although it limits the rateable value to such a sum as would be found within the charges authorized and restricted by the Act, it nevertheless always makes those charges sufficient to pay the outgoings

necessitated by the borrowing of money for the construction of the works, and for the efficient working of them when constructed. A water-works valued in the usual way might produce a higher or a lower result, according to circumstances, but the income of restricted works must always be sufficient to meet the outgoings.

15. Suppose the Local Board, instead of borrowing £48,000, and constructing their own works, had taken a lease of similar works, at a rental of £2,976, or even at a lower rental, say £2,4000, which would have given a five per cent. return on £48,000, would there have been the slightest doubt as to the rateable value of those works, under those circumstances? The Board are authorized to make such a hiring under the 75th Section of "The Public Health Act, 1848." The same amount of income only would have been required as is required now; and who would have said that the rent of a water-works was not the rateable value of those works, just as much as the rent of a house is the rateable value of that house? The amount of rent would depend upon restrictions as to the use to be made of the property, but, in this case, the income which the Corporation yearly raise and pay from the general district rate or the water rate, or both, is sufficient to pay a full remunerative rent.

16. Sometimes doubt arises as to the requirements of the Corporation for works so large as those constructed; but no such doubt can arise in this case because it became absolutely necessary, in 1866, to enlarge the works, which had cost £30,000, by an expenditure upon additional works of £18,000.

17. Sometimes, too, Corporations think they ought not to be rated at all, because they derive no personal benefit from carrying on the works, but simply occupy as trustees for the benefit of others. This view was entirely upset in the case of *The Mayor of Liverpool* v. *The Overseers of*

*West Derby*, where it was held that the Corporation were rateable in respect of the land and buildings occupied by their water-works.

That, however, was not the case at Worcester. The judgment in that case begins with the following words :—

"The question in this case is not the rateability of a "public body in respect of premises occupied by them for "public purposes. That question has been for some time "settled, and it is not disputed that the appellants are liable "to be rated in respect of water-works erected and occupied "by them for the purpose of supplying the inhabitants with "water." And further on, in the same judgment, occur these words :—"The only question is, whether a public "body, exercising their powers properly for the benefit of the "inhabitants, and making their rates *bonâ fide* for that pur-"pose, and so regulating their conduct by the restriction, as "it may be called, of acting in obedience to the Act of "Parliament, can be properly represented, for the purpose "of rating, by a hypothetical tenant, acting under no such "restriction. We are of opinion that they cannot."

Everybody familiar with the subject will agree with the last seven words ; but no such person will agree that, applying these words to the Worcester Water-Works, their rateable value is £540.

18. The fact is that the inhabitants of Worcester do pay, in the shape of interest and sinking fund on borrowed money, a sum, annually, which is equivalent to and sufficient for the payment of rent, and this they do in obedience to and in spite of the restrictions placed upon them, which would not, or might not, apply to a trading company. Therefore, no alternative calculation respecting what other parties might make out of the works arises. The only question which does arise is this—Is the annual value of the works, as a hereditament, to govern that rateable value

or, is some balance of an account arising out of a special mode of book-keeping, to do so?

19. The judgment, as delivered by Baron CLEASBY, was appealed against, and the judgment of the Court of Appeal was delivered by Lord Justice MELLISH, on the 10th November, 1876; but the real point was again overlooked, and does not appear to have been argued before the judges.

The Appeal Court treated the case as though two questions only had to be considered, viz.: first, are the Corporation, according to the true construction of "The Public Health Act," prevented from charging for the use of the water a larger sum than the sum they actually require for the maintenance and repair of the waterworks, &c.; and, secondly, if they are, can they be rated as occupiers in respect of profits which the law does not allow them to earn? With respect to the first question, the Court decided that the Corporation cannot raise a larger sum by a water rate than the sum they require for the maintenance of the water works.

That question was never in doubt; and, if the Corporation had no other powers, there could be no rent, because all the receipts would be expended in maintenance. But they have further powers which they exercise, and they raise sufficient funds to pay their rent, or, what is equivalent to the rent, interest on the money borrowed for the construction of the works, out of the general district rate. *That rent or interest is the rateable value, and not the balance of water rate accidentally left after defraying the expenses of maintenance.*

There should be no part of that sum remaining, because it should not have been raised in excess of what was required; and therefore, legally, there should have been no rateable value.

20. If the general district rate be left out of the question,

the Corporation are in the position of a person who is carrying on a trade in a house, the rent of which is paid for him by some one else. The rateable value of such a house would not be any part of the profit made by the occupier, but it would be measured by the rent which some one else was paying.

21. The Court of Appeal referred to the mode of rating a railway; but they still appear to have overlooked the fact that they were comparing the whole of the sources of income and profit of a railway company with a part only of the income of these water-works.

22. It also referred to the enhanced value of the houses in Worcester in consequence of the cheap supply of water; and they also appear to have overlooked the fact that, although the water rate is low, the houses bear the burden of the general district rate, out of which comes, not only the rent of the works, but also a sinking fund to recoup the capital within thirty years.

23. If benefit to other property is to be a ground for exemption from rating, it is certain that no railway to a town should be rated.

Mr. P. D. Tuckett had great pleasure in proposing a vote of thanks to Mr. Ryde for his Paper. He did not think the Meeting could do better than follow the course taken with Mr. Bazalgette's Paper, and adjourn the discussion until the next Meeting, when the two Papers could be discussed together or consecutively as might be most convenient.

Mr. C. G. Grey (Member), having seconded the vote of thanks to Mr. Ryde,

The President said that he was sure he was only express-

ing the feeling of the Meeting in giving their unanimous vote of thanks to Mr. Ryde for having been so good as to bring the subject under the notice of the Institution. He had no doubt that, after they had carefully gone into the facts, each would have an individual opinion on the subject, and that the subject would be thoroughly exhausted.

The discussion on the Papers of Mr. Bazalgette and Mr. Ryde was then adjourned until the next Meeting.

AT

## THE ORDINARY GENERAL MEETING,

*Held on Monday, March 11th,* 1878.

THE PRESIDENT IN THE CHAIR.

The President said that, before commencing the ordinary business of the Meeting, he had to remind the Members of the death of Mr. Hall, one of the Past-Presidents of the Institution and one of the oldest, most eminent, and most able members of the profession. Personally, he (the President) had known Mr. Hall for forty years, and he was sure that all would fully concur in the expression of sincere sympathy at his decease. As Mr. Hall had held the office of Past-President, his decease did not occasion any vacancy in the Council. But it was also his duty, as the President, to remind them of the death of Mr. Oakley, who was not only one of the oldest and most experienced and esteemed members of the profession, but was also one of the Vice-Presidents of the Institution. In consequence of his decease it was the duty of the Council to recognize the fact, in order that the Members might choose some other fit person to hold his honourable position. There had been a little doubt in the Council, because the period of the Session was so far advanced that some thought it hardly expedient to add another Vice-President for the short period intervening before the General Meeting; but the rules of the Institution were imperative. It therefore was proposed on that day fortnight to make the ordinary Meeting *Special*, in

order to choose a Vice-President. The Council considered it desirable that one of the most eminent of the Members of the Council of the Institution should succeed Mr. Oakley, and therefore they ventured to suggest, for the consideration of the Members, that Mr. I'Anson should be transferred from the position of an ordinary Member of Council to the office of Vice-President. The Council also ventured to suggest that Mr. Thomas Binnie (who was proposed as a Member of the Council at the past annual Meeting, and who would be a worthy representative of Scotland in the Institution), should occupy the position of Mr. I'Anson. The Council merely suggested. It was for the Members to decide in both cases at the ballot on the 25th inst.

The Hon. Secretary informed the Meeting that the Council had nominated the President, Mr. E. J. Smith, to fill the office of a Trustee of the Institution rendered vacant by the death of Mr. Hall. This nomination would be submitted for approval to the Special General Meeting to be held, as announced, on the 25th inst.

The President understood that Mr. Bazalgette was desirous, before the discussion commenced, of making a few observations by way of supplement to the Paper read by him at the last Meeting.

Mr. Bazalgette said that he proposed to make a short verbal addendum to his Paper, which would deal with a scheme which had been brought to his knowledge since his Paper was first submitted to the Institution. He was not at liberty to disclose the quarter from which it came; but he was sure it would command the respect of the Institution, if he were in a position to do so.

It might be remarked that two units of representation had been referred to in his Paper—namely, that proposed by the Bill, the petty-sessional division; and the other, the Union. The scheme he was about to explain suggested the sanitary area as the unit of representation, and thus differed in its basis from the former propositions. He might add that the adoption of this area as the unit was first recommended by the Royal Sanitary Commission in 1877, who then reported to this effect: "Having ascertained a right boundary for local government, all local government should be transacted within it, whether of public health, poor relief, highway management, justice, education, or any other local interests." And, in another passage: "Areas for one purpose must be larger than for another; . . . . but the unit of area should be the same for all local purposes, and larger areas should be, as far as possible, exact multiples or aggregates of that unit."

So that the scheme based upon these recommendations, as regards its physical constitution, came to this—that the urban and rural sanitary districts into which England and Wales were divided by "The Public Health Act, 1872," should be taken as primary districts, and that the county, of which such primary districts would form constituent parts, should be taken as the aggregate district. But this difficulty suggested itself—that, in some cases, the sanitary district overlapped the county boundary. Fortunately, however, it happened that, without having recourse to special legislation, there was already machinery provided for the purpose of correcting this evil. Part 8 of "The Public Health Act, 1875," contained powers for the reduction, absorption, and dissolution of districts; and therefore, wherever the sanitary district was found to overlap the county boundary, it would only be necessary to apply the existing powers, for the purpose of at

once curing the irregularity. In the first instance, no doubt, the primary areas within the aggregate area, or, in other words, the sanitary districts within the county area, would need a certain amount of adjustment with regard to each other and the county. Accordingly, it was proposed that the first duty of the County Board, as the governing authority of the county area, would be to adjust, as far as possible, those units which went to form the aggregate body.

Having then disposed of the area, the next question was what was to be the governing body of the area. In the first place, the primary areas, as he had already pointed out, were to be the rural and urban sanitary districts created by "The Public Health Act, 1872." But a rural district under this Act was controlled by a rural sanitary authority, which was the Board of Guardians; and the Board of Guardians therefore would be the rural primary authority. On the other hand, an urban district was governed by three different kinds of urban authorities—namely, the Borough, the Local Board, and Improvement Commissioners. So much for the governing bodies of the primary area.

The county area had next to be considered, with reference to its controlling authority. The county authority was to be a County Board. But how was this Board to be elected? It had been suggested that one-third of its members should be chosen by the Quarter Sessions, and the other two-thirds by the authorities of primary areas within the county. But the exact proportion which representation should bear to the population was a detail which was not fully worked out in the scheme as it had come to his notice. But of course it was understood that the present proposal had not been fully elaborated in all its parts, and was more in the nature of a sketch than a scheme perfected in all its details. At the same time, he felt confident that, if the same

masterly hand which had drawn the outline should also fill in the details, the scheme would fulfil all the promise which, even in its present immaturity, it disclosed. But the suggestion upon this point was, that areas over a certain population, and under a certain population (the exact figures remaining to be precisely determined), should return one member, and that further members should be returned in numerical proportion. Probably, for the purposes of the first elections of County Boards, some of the smaller sanitary districts would, on account of their insufficient population, be unable to return a member, and, to meet that difficulty, it was proposed that such districts should be grouped together. Then, as already mentioned, the first duty of the elected Board would be to set to work to adjust the areas forming their constituent parts.

He had now dealt with areas and governing bodies, and the next question to be considered was that of the functions which were to be discharged upon the primary and aggregate areas by their controlling authorities. Taking the primary area first, the functions that had been suggested were these. The primary area being the sanitary area, naturally applied the provisions of the Public Health and Sanitary Acts. Moreover, it would, in the case of urban districts, provide for the maintenance and repair of highways, and, in the case of rural districts, would undertake the relief of the poor so far as outdoor relief was concerned. It would also have the duty of vaccination cast upon it, the discharge of the Elementary Education Acts, and serve as the Burial Board for its district. He thought it would be observed by all the Members interested in the subject that this went a long way towards the discharge of all the duties which could be considered strictly local duties, and, comprising many of them within the same area, compelled their fulfilment by the same authority. The authority in an

urban district, as now constituted, could practically perform all these duties except outdoor relief; while in rural districts all these functions, except that of surveyors of highways, could practically be discharged by the rural authority; so that the scheme provided for the performance of many local duties by one authority, within one area, without any great disturbance of things, the only material alterations being that, in the case of an urban district, there was a transfer of the outdoor relief function to the urban authority; and in the case of a rural district there was a transfer of the surveyorship of highways to the rural authority. Well, then, a difficulty arose even upon so slight a disturbance as that mentioned, and that difficulty was that the workhouses and other buildings constructed for the purposes of indoor relief had been adapted to the requirements of the union as an area, and some re-adjustment would therefore become necessary if the duty of administering indoor relief were transferred to an urban authority.

It was proposed, in order to meet that difficulty, that indoor relief should be vested in the hands of the aggregate authority, outdoor relief being left to the primary authority. But how would this work? He might explain, for the present purpose, that the effect would be this. Application in the first instance would be made to the primary authority, as it was now made to the guardians. The primary authority would then have to consider that application from two points of view: first, whether the case was a deserving one and a proper one to relieve at all; and secondly, assuming that it was a proper case, whether the relief should be administered in the shape of indoor or outdoor relief. If the primary authority decided that it was a case for outdoor relief, the primary area would be responsible for the administration of that relief, and the cost would fall as a charge upon the primary area. If, on the other hand, it decided that i

was a case for indoor relief, it would then have to make an order for admission to the nearest and most convenient county workhouse, into which the applicant would, of course, have to be admitted. Then, as regarded the charge, the proposal went to this—that the charge might either fall as a complete charge upon the county, or the county might recover a certain fixed sum, per head, per week, from the primary area, and the balance, whatever the balance might be, should fall on the county common fund leviable over the whole county area.

It was said that, independently of the convenience afforded by that method of arrangement, it possessed the further advantage of enabling the workhouses to be set aside for special purposes,—as, for example, some workhouses for able-bodied paupers, some for the infirm, and some for children, and so on.

He next came to another important branch of the functions to be discharged by these bodies—namely, the care of the main roads. There, again, the suggestion was this, that every primary area was to be a contributory area to the county area for the purposes of main roads. The County Board, in the first instance, was to divide all the roads in the county into (1) main roads and (2) local roads. But, perhaps, it would be well to explain what was meant in this suggestion by the term "main roads." The term "main roads" did not merely refer to those roads which had been made the subject of turnpike trusts, and which had been dispiked, but it also referred to all roads which not only served the local traffic of the primary area, but which carried through traffic into some other primary area or served the purposes of the traffic of the county.

The obligation of repair and maintenance in every case, whether a main road or a local road, was to devolve upon the primary area, and the principle of charge was to be this—

that the cost incurred in respect of every local road, which served merely the purposes of local traffic, should be a charge on the primary area. On the other hand, the cost of main roads, so far as they served the purposes of local roads within the primary area, should fall upon the primary area to that extent; but, so far as they served for general traffic, the expense was to be borne by the general county fund. This brought him to the end of his description of the skeleton scheme suggested, and all he had to add was with regard to the contribution to be paid by the county to the cost of the main roads. The proposal in this respect was that the contribution was to be paid on the certificate of the Surveyor. Whenever the Surveyor certified that the road had been repaired a cheque was to be drawn on the county fund to an amount corresponding with the work done. It was also proposed that contributions to the common fund should be paid in proportion to their rateable value, and that the duty of valuation should be transferred from the present authority to the County Board.

The President said that the Meeting had, no doubt, been glad to hear the further explanations and observations of the Author of the Paper. Of course, it was impossible for Members, on the instant, to duly appreciate all the additional points which Mr. Bazalgette had put forward in the course of his remarks, and he apprehended that the discussion was intended to proceed upon the Paper which had been printed and issued to Members, and which they had consequently had the opportunity of considering. According to the Author (page 156 of the Paper), the object of the existing county machinery is twofold—Imperial purposes and local government purposes. It remained to be determined how these two purposes are to be carried out, in future, in the easiest form.

Mr. W. H. Michael (Associate) thought that the Members and Associates of the Institution were very much indebted to Mr. Bazalgette for the able manner in which he had introduced the subject. Analytical Papers of this kind were of great practical interest, and formed additions of permanent value to the "Transactions." His friend, Mr. Bazalgette, was content to give an abstract of the provisions of the Bill; but he, Mr. Michael, was more ambitious and perhaps less successful, for he proposed, in the course of the observations he should make, to develop his own views with reference to legislation on this important subject. These views he had been urging (unfortunately without much effect) upon successive Governments for years past, and had given expression to them in many forms and on many occasions.

He must at once confess that, taking into consideration the circumstances attending the introduction of the Bill into Parliament, he had not expected much from the measure, and did not therefore feel any particular surprise or disappointment when he found how meagre and timid the Bill proved to be. Looking at the scope of the Bill, it would be observed that, in the first place, it left matters very much as they were before, doing little else than transferring and reallotting duties and administrative functions. Its prevailing vice was one especially fatal in sanitary legislation; it gave the carrying out of its objects to persons notoriously adverse to measures requiring a large immediate outlay, and who needed, in the great majority of cases, much moral, and occasionally some physical, pressure before they could be taught that the money so spent would result to their own ultimate advantage.

The powers conferred by the Bill in respect to the conservancy of rivers he took to be utterly valueless, on two grounds—first, because that they were not compulsory;

and secondly, because the Board, as constituted under the Bill, would be totally incompetent to deal with such matters. Moreover, the conservancy of rivers was not enough. The scope of these powers should extend to watershed areas, and until this was done and adequate powers to enforce an effective dealing with such matters were given, interests of the greatest importance to the well-being of the population of England would go uncared for.

The Bill, it would be observed, gave power with respect to the election of coroners. He might be allowed to mention that he was the first person to propose the desirability of investing County Boards with these elections. The Bill also provided for the erection of asylums for imbecile and pauper children. It had been asserted, on high authority and with some truth, that, in order to gain the assent of Parliament to a principle, it was necessary, to educate Parliament, as it were;—that, to carry any great measure through Parliament, it was necessary to begin with the thin edge of the wedge, and go on improving the legislation year by year, until a perfect measure was attained. This might be so, where the first measures were of a kind tending towards the ultimate objects in view. It was a different thing altogether to commence by creating a body totally incompetent to carry out the end desired. Clearly, the first thing to be done here was to divide the whole country into uniform districts, under local authority, and confer powers by a single Act of Parliament, drawn in a simple and intelligible form, for the carrying out of all the functions and purposes of local government. To secure efficiency of action, with a true and far-seeing spirit of economy, matters must be dealt with in such a way as to satisfy those whose money was being expended that it was being employed in their own interests and not being squandered. The present system of carrying

out the sanitary work of the country was not only most wasteful, but most ineffectual also.

What could be more obvious than the desirability of securing that proper sanitary requirements should be observed in the erection of new houses and buildings outside the limits of urban districts? Yet there was no power whatever in the urban sanitary authority to deal with them, and the consequence was, that a mass of buildings of a highly insanitary character was springing up, on the outskirts of towns, erected by persons desirous of evading borough rates, and absolutely independent of all proper control. The first thing to do was to remove these anomalies by dividing England into comprehensive districts; the next, to establish a system of local government, under the control of a competent authority, which should have all necessary powers to carry out and to deal with all purposes of local and municipal government in an effective manner. The co-existence of three or four sets of authority—three surveyors and three clerks, and three treasurers, three collectors of rates, and so on—simply meant the multiplication of expenses, and administrative confusion. Let there be but one body—whether a Municipal or Local Board, he did not care, so that the employment and adequate payment of efficient officers were secured. It was especially necessary that competent Surveyors should be appointed, for the Surveyors and the Medical Officers of Health were the backbone of the whole of sanitary efficiency. One single and powerful body of the kind in each district, uniting in itself all functions of local management, was what was really needed—a body in a position to say, "This is my area, this is my authority, these are my powers." But there was something very much beyond all this. Suppose that the whole of England were divided in the way he suggested—say, for argument's sake, into fifty local authorities—all exercising powers within their

districts of a kind suited to the needs of their districts; and suppose that the highest degree of efficiency and economy of expenditure had been attained. There would still remain functions of the utmost importance to be carried out by the County or General Board, which would be necessary for exercising, for some purposes, authority over the whole area comprised within the fifty local districts. This County or General Board he would make a representative body, constituted in this manner. Assume that the whole of England were divided into ten general districts. In each of these general districts there would consequently be five local districts, and in order to make the General Board purely representative of the local districts, the five chairmen of those local authorities should have seats at the County or General Board. He would then allow the Court of Quarter Sessions to appoint five magistrates or five owners of property, and would give the owners of property a strong representative character. What, then, would be the functions which such a Board would be required to discharge? They would clearly be those joint powers which could only be exercised by some joint Board of the kind.

The question of the conservancy of whole watershed areas was one which pressed on the attention of all men of philanthropic instincts. It was a matter of paramount importance that every district of England should have an adequate supply of water. It was painful to see the straits to which the populations of some districts were reduced for want of water, because the rural or other authorities did not or could not do their duty, by bringing it in sufficient abundance to the poor man's door. It was pitiable to know what filth the poor were compelled to drink, and to hear of the consequent prevalence of fevers and other diseases of a most disastrous but preventible type, and all because

there was no existing authority competent to provide an adequate supply of water.

The General Board should be as strong and authoritative a body as possible—fit to be a court of appeal on all matters jointly affecting the local authorities. The whole gist of his suggestion lay in this—that the power should be local, and not centralized in London. No inspector, no matter how competent, sent down to hold a local inquiry, could deal so satisfactorily with the special requirements of a neighbourhood as a body constituted in the manner he had suggested, and, owing to their knowledge of local needs, able to decide what was best to be done, and who should do it. Various other matters, such as appeals between the ratepayers of different districts, would come appropriately under the cognizance of such Boards. Such County Boards as these would, in fact, carry out and supplement local government, and a remedy would thus be found to the present anomalous arrangements under which it was not unusual to find three or four local boards overlapping, so that it was impossible to get accurate returns from any single district in England. So great was this confusion of local boards, town improvement commissioners, urban and rural sanitary authorities and what not, that it was impossible to get information sufficient even for guidance towards determining what remedial measures were necessary. He therefore proposed to "take the bull by the horns" at once. Let there be no half and half measures, which were perfectly useless, and must be soon modified or repealed. It was necessary to go upon other lines than those selected for this Bill.

Why were boards of guardians selected for these duties under "The Public Health Act"? Surely not because they were fit to carry out the duties. To his knowledge the duties thrust on boards of guardians were so various and so

constantly increasing that these Boards were totally unable to devote the requisite time and attention to their discharge, and the consequence was that they were neglected. The guardians were, in fact, unfit for them. The only reason for selecting the guardians was that they were a body already in existence, and the same insufficient reason had prevailed with those who framed the provisions of the Bill under discussion, in inducing them to select the petty sessional division as the area of representation.

Mr. J. Shaw (Member) agreed to a great extent with the observations of Mr. Michael; but he thought that the sanitary question was not the only, or, indeed, the main, question which was proposed to be dealt with by the Bill. As he understood the Bill, it was for county administration and for county finance as it at present existed, and the Government were, he thought, deserving of credit for having introduced the Bill. It was not, perhaps, so comprehensive as some might desire, but, taking all the circumstances into consideration, it might be fairly described as a very satisfactory measure.

He thought that Mr. Bazalgette's Paper gave a very clear and accurate sketch of the nature and limits of the duties of existing local authorities, but he did not agree with Mr. Bazalgette that the Bill was but "a tame remedy" for the evils which existed; and in this opinion he was supported by most of the Chambers of Agriculture who had discussed the Bill.

There was no doubt that, in many respects the union would have formed the most desirable unit of area, but his experience had convinced him that the union was an area which did not readily adapt itself to purposes of county representation. There were several cases in his own district where, as between one county and the adjoining

one, it would be extremely difficult to divide the unions and to devise a system of satisfactory representation in respect of them. A good deal had been said about the desirability of direct representation. He confessed that he himself saw objections to it, and thought that the representation proposed by the Bill was one of the best that could be devised under the circumstances. He did not consider the board of guardians, as at present constituted, an altogether satisfactory elective body; but he hoped now that the Bill had come so prominently before the public that much more attention would be paid to the election of guardians than had hitherto been the case, and, therefore, that a better class of men would be elected to the office.

A good deal had been said about the proper proportion of magistrates to elective members on these Boards. A suggestion had been made elsewhere that one-third of the members of the County Boards should be elected by the magistrates, and the other two-thirds by the guardians. He might mention that a friend of his, who took great interest in these matters, and was well qualified to give an opinion, had proposed that, instead of four members for each petty sessional division, five should be appointed, two by the Magistrates in Quarter Sessions, and three by the Board of Guardians. He was not, however, prepared to say that this would be an improvement, so far as the quality of the Board was concerned. It would be observed, with reference to this point, that the number of magistrates and elective guardians would not in all cases be equal, for a borough with over 20,000 inhabitants would have the opportunity of returning four elective members, and there would thus, in some counties, be a majority of elected members over magistrates.

As regarded the time for which the members should be elected. It had been suggested that the election should be for three years, and he was inclined to think that this would

be an improvement, seeing that it would take some time for the members to get properly acquainted with their duties.

It might be desirable to retain the highway authority, as proposed in the Bill; but certain improvements in the details of working might, he thought, with some advantage, be embodied in the "Highway Bill" now before Parliament.

An observation was suggested to his mind by the supplementary remarks of Mr. Bazalgette, and by the remarks of Mr. Michael. There were cases in which urban powers were exercised by rural sanitary authorities, such as those for the construction of sewers and the erection of water-works. He was himself carrying out some works for a rural sanitary authority, who were exercising the same powers as an urban sanitary authority. As he had already said, the new Board was mainly designed for the management of county finance, and he did not think that the proposed constitution could be greatly improved.

Captain P. G. Craigie (Visitor) had listened to the observations of the previous speakers with very great interest. The Paper under discussion had received two supplements of a very important and far-reaching character. He did not, however, think that any advantage would be gained by extending the discussion beyond the consideration of the original Paper, for to enter upon the topics embraced within Mr. Bazalgette's opening remarks and Mr. Michael's observations would be to re-open the whole question of local government reform, instead of discussing the Government Bill. He could not endorse the opinion just expressed as to the excellence of the Bill in all particulars. The measure was an important step in local government reform, and, if certain conspicuous faults were rectified (which he trusted would be the case), would go far towards accomplishing the reform which it was hoped it would effect. Neither could he

endorse the sweeping condemnation which had been passed on the Bill by Mr. Michael, or think that it should be flung back to the Government as a bald and wholly unsatisfactory measure. In local government reform it was necessary to proceed by measures which, if not quite so satisfactory as could be wished, were successive steps in the right direction. That a simple and more comprehensive plan was needed for the general administration of local affairs was undeniable. He entirely concurred with those who desired one authority only in each district, exercising all powers of every kind within the district on one uniform basis; but the practical and experienced gentlemen whom he saw around him knew that no one measure of so comprehensive a kind had any chance whatever of passing through the House of Commons. It might not be possible to proceed with scientific thoroughness and completeness, but it was better to make some progress, however small, than to lay the whole matter aside because their wishes were not met in every particular.

Under the Bill, the County Board would carry on the new duties as well as the quarter sessions duties with which they were previously charged. The transfer of the quarter sessions duties alone had been for forty years attempted on various occasions, and had signally failed for the good reason that the various functions of quarter sessions had been, in practice, well discharged by the magistracy. The introduction of the elective principle would now probably be successful, and give the court the requisite qualification for dealing with new and wholly diverse functions for which some relation between the governed and the governor was essential.

The electoral area proposed by the Bill did not meet with his approval. He would greatly have preferred the union, and in country districts it must be remembered that the union was practically the sanitary authority. It was

true that there were 181 unions crossing the county boundaries, but there were 469 unions which did not cross the county boundaries, and, pending the adjustment of boundaries, the fractions which crossed these county boundaries might, for electoral purposes, if large enough, have one member each, and if only small be temporarily attached to the counties which they invaded. A smaller transfer of parishes would thus be effected than was proposed by the Bill. Every objection to the union as crossing boundaries applied equally to sanitary areas, and a readjustment was therefore desirable. But a central authority, however willing, would fail to carry out the rectification of county boundaries, unless it had local support. It would get that local support only by having local attention directed to it, and this would be secured by grouping the divided unions in the way he had suggested.

He thought that the highway and sanitary areas ought to be in every way identical, thus getting rid of one of the anomalies so vexing at the present time. He looked forward to the ultimate identification of poor law administration in the same areas; but to propose this now as was done this evening, and to add a sweeping poor law reform by way of amendment to a County Board Bill which was not really practicable.

It was a very serious and very large question, to the settlement of which he looked forward with great hope for economic as well as for other reasons.

Until there was a proper rectification of boundaries, it would not be possible to make everything ship-shape; but he hoped that the Members would share his opinion that the best hope of an easy solution of the difficulties of local administrative reform would be found in keeping to the union as the electoral area and using leverage thus obtained for further progress on the work of consolidating areas.

Mr. C. G. Grey (Member) said he would confine his remarks as much as possible to the Bill under discussion. The subject introduced by Mr. Bazalgette in his supplemental Paper was one which presented points which he (Mr. Grey) had considered for many years past, in conjunction with men of great experience in local affairs If Mr. Michael's plan were carried out—if the whole kingdom were laid out like a chess-board, and Parliament were educated up to the point of sanctioning such a scheme of wholesale re-arrangement,—the results would, no doubt, be very excellent; but he believed, as a matter of fact, that it would be utterly impossible to pass any such measure, which was inconsistent with the physical conformation of the kingdom.

It was generally admitted that county finance had been well administered by the justices, and he was not prepared to say that the proposed County Board would manage it better: yet there had been a very general desire in the country for a representation of ratepayers in the administration of county finance, and he thought the change in this respect might have a very good effect. But if the "principle of direct representation" were adopted, there was some risk of carrying the representation of ratepayers too far.

There had been instances of this in some School Board districts. Take a district where, perhaps, 90 per cent. of the rateable value was represented by large colliery and land owners, and the remainder by small ratepayers. A Board elected under such conditions represented an extremely small fraction of the rateable value of the district. It was not uncommonly found also in these cases that the interest represented was not that of the ratepayers only, but of friends, for whom enormous building contracts were secured, and the result had been, in some cases, that the large ratepayers had been saddled for years with rates for vast and expensive

buildings, over the erection of which they were comparatively without control. For this and other reasons, he thought that representation might be carried too far. It was wished by some prominent politicians to make the Bill a scheme for teaching the lower classes their duty as electors. His own opinion was that it was a Bill for securing a good and efficient County Board machinery, and he believed that the wished-for result would be attained by its means. The proposed mode of election, he thought, gave promise of a satisfactory result. The Boards of Guardians, in his experience, contained some men not competent to administer affairs beyond their district; and he hoped and believed that, if the plan proposed in the Bill were ultimately adopted, the more intellectual members of these Boards would be elected to the County Boards. Then, as to the new area. It had been asserted that the difficulty of making a Union the unit of area was insurmountable, on account of the number of Unions crossing the county boundaries. However great that difficulty might be, it might, he thought, be surmounted in some way or another, for it was a most important step in the direction in which all wished to move in legislation of this nature, that one area should be adopted for all purposes. Now, as far as he could judge, the nearest approach to the proper area was the Union as at present existing. The Union generally represented the rural sanitary authority, and, in one or two cases where he was aware of its overlapping county boundaries, the different parts in such counties might have certain portions of representation assigned to them. As Mr. Shaw had suggested, if the Union were divided unequally, the small proportion of representatives in one county might, for the purposes of election to the County Board, be thrown into the adjoining Union in the county in which it was situated. This would be much easier than entirely re-arranging

the existing Unions. He assumed that, to completely re-model the country and to upset the Union areas would be to effect such sweeping changes as to produce great difficulty and perplexity for some time to come.

Now Mr. Michael had complained that the Bill was bald and incomplete. Some day, many of the reforms advocated by Mr. Michael might be embodied in a Bill of larger dimensions than the present one, but meanwhile several important improvements might be effected. The principal object of the Bill under discussion was to constitute a County Board, but clauses 9 to 21 related to highways. He had in his hand the new Highway Bill. Now what, after the County Board was constituted, was to prevent the passing of a Highway Bill, with powers to the new County Boards, as an already constituted authority, to put it into execution? There was also a Valuation Bill before Parliament, which Bill, he understood, contemplated the formation of a County Board somewhat different in character from the County Boards of the Bill under discussion. It was proposed, he believed, in this Valuation Bill, that the County Board for that purpose should be elected by the Unions. If this were so, it was probable that, before it became law, it would be altered so as to accord with the form that the ultimate legislation on the County Board question would assume, leaving it to one Board to regulate all matters relating to county government.

He agreed with a previous speaker (Mr. Shaw) that the members of the Board should be elected for three years, a third of the members retiring every year, to afford an opportunity of bringing in new vigour. He also thought, if practicable, that the number of representatives should bear some relation to population, area, and value.

As to the question of conservancy. A great deal had

been said about watershed areas. It was clear that it would be impossible to divide the country into anything like equal districts for rating purposes if watersheds were taken as the areas.

He might, perhaps, be permitted to make reference to the clauses of the Highway Bill. He had given great attention to the subject, and had been an active member of boards of guardians for twenty-five years, half of which time had been spent in the northern counties, and the other half in Ireland, and he said, without fear of contradiction, that the management of the highways in Ireland was infinitely superior to anything he had seen in this country, and was very simple and equitable. In the present system of highway management in this country, there were great hardships and great anomalies. The parishes in the north of England were townships many of them very small. He knew one instance of a township where the only ratepayer was a widow, who had to hold her meetings in her parlour, and ask some friends in the neighbourhood to act as guardian and way-warden. She naturally felt it an injustice to have to keep roads in order for the use of other people, and they were therefore neglected. The only means of forcing these small ratepayers to repair roads was by law, and that was very seldom resorted to, owing to the expense attending legal proceedings in matters of the kind. The conclusion he had arrived at was that the areas for the highways ought to be the same as for sanitary and poor law administration; and the rate a uniform rate over the area.

Provision was made in clause 11 of the Bill for throwing half the expense of maintaining main roads on the county. It was proposed by Mr. Bazalgette that the amount of expense which would keep the road in sufficient repair for the local traffic should be paid by the smaller area, and that the excess should be paid by the county.

This plan, however, seemed to him (Mr. GREY) to be impracticable. He failed to see how it would be possible to assess the relative amounts. There was in "The Highway Bill" provision that, after the 1st April, 1879, the rates of the highways were to be equal over the district, and there was also provision for making a sanitary authority the highway board, and the County Boards were empowered by order to abolish the separate functions of the highway board.

The 14th clause he conceived must be abandoned. The feeling of the country was unanimous, he thought, against paying tolls; and there was this objection to it (apart from the personal inconvenience of the system), namely, that it was a most expensive method of raising a revenue. The county authorities, if they chose, could surround the borough with toll gates, and, as he had said, he could not imagine a more expensive and unpopular way of raising a revenue. A wheel-tax had been suggested. The proposal did not present itself favourably to his mind; but he thought that a contribution from the adjacent area might be determined by arbitration.

Clause 16 enabled the tenants to deduct from the person to whom they paid rent, the rate for certain purposes. This system had existed in Ireland for a very long period of time; and in Scotland the custom was for the owner to pay the larger portion, and in Ireland, half. It was contended that no matter what interior arrangement was made, the rate ultimately fell upon the owner of land. That was so, perhaps, as a general rule; but in the case, say, of a twenty-one years' lease where the local rates at the commencement had been £20 a year, and, before ten years, had increased to £120, this could hardly be said to be the case. For this reason he believed that the system prevailing in Ireland often prevented great injustice being done to the occupier.

He would allude only to one or two other points. First,

as to Clause 24, he thought that the jurisdiction of the County Board should be extended to industrial schools. Then, as to Clause 26. It would be a great advantage if powers as a public prosecutor were vested in the coroner. As regarded Clause 47, he could not help thinking that all assessment appeals should lie with the County Board, thus securing an uniform and intelligible system of rating.

Mr. E. J. Castle (Associate) said that he could not help thinking that great care should be taken in introducing new elements into the government of counties. The abstract proposition that representation and taxation should go together was all very well in its way, but it should not be forgotten that it was held by many very competent authorities that the person who ultimately paid the tax was the landlord. Consequently, he was the person who was most interested in controlling the enormous and continually increasing expenditure for purposes of local government. All who had practical experience of the Courts of Quarter Sessions agreed that they had performed their various functions in a manner most satisfactory to the public. Where, then, was the necessity for violent changes? The introduction of the new elective element into county administration would, he feared, result in leaving the county business in the hands of men whose only ambition was to obtain local popularity.

After all, these Boards did not depend altogether upon their constitution for their efficiency. As a matter of fact, it was the executive which was the real working power, and so long as the surveyors, medical officers, inspectors, or whoever they might be, were well selected, it was comparatively unimportant who sat upon the Board.

On the whole, he thought that the country was very well content with the present Boards of Magistrates,

who were people of position, and felt a strong interest in the conduct of local affairs.

Mr. J. Clutton (Past-President) said that he might observe, with reference to the question of highways, that he lived for three months of the year in the county of Ross, where the highways had been placed under the control of a single body, composed half of owners and half of tenants. The result had been a great improvement in the roads. There was not a single turnpike gate in the district. The part of the new Bill which referred to the erection of toll gates was, he thought, objectionable; and he had not the slightest doubt that, if all the highways were placed under one Board, with an efficient treasurer at the head of it, and proper subordinate officers under him, the highway rates of the whole district would be very much diminished. The adoption of this system would get rid of the necessity for contributions to what were called main roads, for everybody in the county would contribute towards the main road by a uniform rate.

The county business was so well managed by the Quarter Sessions at the present time that it was, he thought, a pity to make any changes which might impair the fitness of the present county authority for dealing with county matters.

Mr. E. Ryde (Vice-President) said that Mr. Bazalgette had suggested that to take the sanitary area as the unit would be a step in the direction of simplification. Whether this would always be so, the Members might judge by the case of the town of Tunbridge Wells. Tunbridge Wells was governed by a body of commissioners for all town purposes. As he understood Mr. Bazalgette's proposition, he would separate that part of the town which lay in the

county of Sussex from the other part, which lay in the county of Kent, thus placing the town under the jurisdiction of two separate sanitary authorities. This was, to say the least of it, a doubtful step in the direction of simplification.

Mr. C. N. Bazalgette said that he scarcely expected to be called upon so soon to reply on the whole of the discussion. He hoped, however, to be able to prove, within the limited time at his disposal, that little cause had been shown against the suggestion he had offered that the sanitary area was the best unit of administration. Mr. Ryde had actually succeeded in discovering a single case in which a town overlapped the county boundary. Well, suppose a town here and there did overlap the county boundary, what was the difficulty about cutting off the portion so overlapping, and absorbing it into the adjoining sanitary district, or regulating the county boundary so as to include the town? He believed, however, that the case cited by Mr. Ryde was an isolated one. Exceptions proved the rule. Take the case of the Unions which the last speaker but one advocated. It was admitted that no less than 181 Unions transgressed the county boundary. If one isolated difficulty about a boundary was to condemn the sanitary district as the unit of area, what was to become of the suggestion, that the Union be taken as the unit? It had been maintained, and with truth, that in "The Public Health Act" all the powers were ready to hand and ready to set in motion if the sanitary districts were taken as the unit. In Part 8 of "The Public Health Act" powers were granted for the dissolution, absorption, reduction, or augmentation of districts; therefore, if the sanitary district were out of harmony with the county boundary, or any other boundary, all that it was necessary to do was to set in motion existing legislation, and adjust the boundaries in the manner thought desirable. The fact was, it was

impossible to invent a machinery for the purpose which would not produce some disturbance or inconvenience; but he believed that the least possible disturbance would result if the sanitary area were taken as the unit. It was no doubt true that the sanitary district did not represent the water-shed for drainage purposes; but some objection or another might be urged against any suggestion.

He did not think that it had been observed in the course of the discussion that one particular disturbance would be involved by the adoption of the sanitary district as the administrative unit—namely, that the transfer of the powers proposed in the scheme he had hurriedly sketched would get rid of the union and highway boards and concentrate all their duties within one authority. In conclusion, he begged to thank the Institution for the kind reception accorded to his Paper.

The President said he should only make a few observations, and those were intended to refer to points which had hardly been noticed in the discussion.

The chief points were, whether the Petty Sessional areas should be adopted, as proposed in the Government Bill, or the Union areas, or (as had been suggested that evening), the Sanitary areas. He did not think that any reference had been made to the fact that the Petty Sessional areas are taken for Imperial purposes, although, on page 156 of Mr. Bazalgette's extremely able Paper, the Imperial purposes were set out as "the maintenance of the Queen's peace, the militia, the local administration of justice, and Parliamentary representation," and the Local Government purposes, as "county bridges, gaols, shire-halls, and other county buildings, police, asylums, licensing, valuations, the application of 'The District Highway Acts, 1862 and 1864,' and the control, by way of appeal or

otherwise, under various Local Acts, of many local authorities." The Imperial purposes were, and always had been, under the control of the Justices of the County and County Officers; and the point in his mind was, whether these local subjects should also come under the control of the persons who had charge of the Imperial subjects, or whether they should be placed under the control of Union Boards, Highway Boards, and Sanitary Boards, and of their officers. The course he should prefer would be that the Imperial purposes and the local purposes should all come under the control of the same persons, and that, as he understood it, was the object of the Government Bill, for it began, "The Court of Quarter Sessions of a county, when discharging judicial business, or any business relating to prisons or police, shall be constituted, as hitherto, by the Justices of the County in Sessions assembled; but, save as aforesaid, shall be constituted as a County Board." The object appeared to be, to have the whole county business governed from the same central body, with additions according to the nature of the business. This could hardly be effected if the Union, or Boards formed for sanitary purposes, were adopted as the unit. If the County were under the control of the Justices and of County Officers, it would be easy, from time to time, to alter the extent of Unions, or of sanitary districts, to correspond with the county boundaries. A clause provided (Clause 25), that the areas of any Unions, or the areas of any sanitary districts may be re-adjusted according to the boundaries of the Sessional areas. This seemed to him the gist of the proposals, and therefore he ventured to add these observations to the discussion.

The Meeting then adjourned.

AT

## THE ORDINARY GENERAL MEETING,

*Held on Monday, February 25th,* 1878.

EDWARD RYDE, VICE-PRESIDENT, IN THE CHAIR.

A discussion took place on the Paper read by Mr. E. Ryde, at the Meeting of February 25th, on "The Rating of Worcester Water-works."

Mr. W. Fowler (Member) said that, having made the assessment in question, for the Droitwich Union, he would like to say a few words with reference thereto.

He was convinced that the appeal was lost solely because the judges before whom the question was tried had not before them the whole facts of the case.

He would not presume to question the soundness of the law laid down by these learned judges, but, setting aside purely legal considerations, he ventured to think himself competent to form an opinion on the facts.

The truth was there were two points in the case, and unluckily the whole argument, and eventually the decision, appears to have been founded upon the weaker of the two.

The appellants' contention from the first was that they were so hampered by various Acts of Parliament that they were prevented from making more than a very small profit upon the sale of water, and therefore ought not to be rated at more than £600 gross, and £540 rateable value; the fact being that, if their argument were sound, they ought not to be rated at all, because so far from making even a small

profit they were obliged to levy a water rate to cover working expenses.

He endeavoured to show, and he thought did show, that the appellants might, if they liked, have made a substantial profit from the water-works, notwithstanding the Acts of Parliament in question; but he did not assess them on that footing, but only at that sum which he contended was the minimum that a water-works company should under any circumstances be assessed at, whether a corporation seeking only the health and comfort of the ratepayers, or a trading company carrying on their business at a small profit, or say (for the sake of argument) even at a positive loss.

This minimum sum was the fair and reasonable rental of the premises occupied. A farm or a shop was rated up to its rental, whether the tenant made a profit or loss by his trade, and why not a water-works?

In the present case the Worcester Corporation desired to obtain good and cheap water for the inhabitants of the city. They could not procure it at home, and therefore went into another parish, in another union, and there erected pumping engines, and constructed reservoirs and filter beds and all other necessary appliances of a water-works, sufficient to furnish the city of Worcester with the needful supply of water. For this purpose they must either find a landlord willing to erect, and let to them the necessary works, or they must borrow the money and erect them themselves, and thus become their own landlord. For the purposes of assessment, it was perfectly immaterial which course was adopted; but it happened that the Worcester Corporation took the latter course—they borrowed the money and erected the works themselves.

All the works separately rateable, except some of the main pipes, were situated in Claines Parish and Droitwich Union, and not in Worcester City or Union.

He ascertained beyond doubt that the total cost of the works was about £43,700, and the cost of that portion situated in Claines Parish £35,000, approximately. This fact was never disputed; and, finding that under the circumstances it was impossible to rate the works in the ordinary way, according to the *profits* of the concern, he rated them at what he considered to be the minimum under any circumstances whatever, viz., the rent which the appellants must have paid to a landlord, if they had found one willing to construct the works for them—that is to say, five per cent. upon the actual cost. This would make the gross estimated rental £1,750, from which he took off twenty per cent. for the statutable deductions, leaving the rateable value £1,400.

Now, inasmuch as the Corporation constructed their works with borrowed money, and paid interest thereon equal to the sum at which he assessed them, practically that was the rent actually paid for the works; and that, he contended, should be the minimum assessment, even if the whole water-supply of the city of Worcester were gratuitous, and no income whatever was derived from the sale of the water.

If the Corporation of Worcester were under an obligation by law to supply the whole city with water free of cost, they could not do it without the necessary works; and these works must be rated according to their rental value, whether a source of profit or of loss.

He was not in Court on either occasion when the case was argued, but he was most anxious, on the last appeal, that this view of the case should be pressed upon the Court; but this was not done, he believed. In fact, the judges appeared to have been under the impression that the Corporation had been rated according to the supposed profits they might have made under a different state of circum-

stances; and this they held (doubtless correctly) to be illegal.

On the first appeal, the Court took the somewhat unusual course of requesting to be informed on what principle the rate had been made; and, in reply to this inquiry, the following Paper was submitted for their consideration:—

## Basis of Valuation.

If valued as an ordinary trading Company, I should have valued these water-works in the first instance *as a whole*, whether extending into one or more parishes.

Having ascertained the net profits of the whole, and deduced therefrom an estimate of the annual letting value, I should then have deducted therefrom a percentage, say 5 per cent., on the cost of the reservoirs, pumping engines, main pipes, and works, and credited the same exclusively to the parishes in which such works were respectively situate, and the residue of the annual rental would then have been divided, in the ordinary way, among the parishes into and through which the mains and service pipes pass, the parish or parishes containing the reservoirs, &c., receiving, in addition to the before-mentioned 5 per cent., its or their fair proportion of such surplus.

From a personal survey of the Worcester Water-works, I ascertained that they had every capacity for carrying on a profitable business, and to earn profits; but I also found that, from the mode in which they were carried on by the Corporation, the fair rateable value could not be arrived at *from the receipts of the concern* in the ordinary way.

Being thus deprived of the ordinary data upon which to base my calculations, but it being, at the same time, evident from my survey that the works had the capacity to earn profits as other water-works which were worked commercially, I applied the general principle of valuation before mentioned, so far as my data carried me, in the following manner, viz.:—

| | £ |
|---|---|
| Ascertained cost of works in Claines Parish | 35,000 |
| Estimated annual value which would be credited to Claines Parish in respect of such outlay in priority to the general apportionment of the residue of annual value - - - - - | 1,750 |
| Less 20 per cent. for repairs, renewals, &c. | 350 |
| Leaving the rateable value - - - | £1,400 |

Having no further data to guide me, I estimated the rateable value of the Worcester Water-works in Claines Parish at £1,400; which sum, however, is far below the real value, if the works are rated as if in the hands of a trading company who would charge the ordinary fair and usual price for the water supplied to their customers.

Notwithstanding this explanation, the Court appeared to have acted on the assumption that the assessment had been based upon a supposititious estimate of profits which had not been realized, and to have overlooked the fact that the Worcester Corporation, being under the obligation to supply cheap water to the city, could not do so without certain costly works, for which, in some shape or other, a rental equal to at least five per cent. on the cost must inevitably be paid; and thus, in his opinion, a signal failure of justice had occurred.

Mr. E. J. Castle (Associate) felt himself to some extent in an anomalous position in speaking on this subject, as he happened to be one of the counsel in the case under discussion.

He might, however, briefly state what appeared to him to be the real points of the case. It was known to all, that the rating of property was based upon the value of the occupation to the occupier, in accordance with the provisions of the Statute of William IV. In the majority of instances this

principle was easy of application, but this particular case involved the difficult problem of how far the various facts under which an occupation existed were to be taken into account in valuing the occupation. Mr. Ryde's Paper had raised this question, but had raised it in an entirely different form from that adopted by Mr. Fowler in his remarks that evening. Mr. Fowler had contended that the question was never properly raised for the opinion of the Court; but Mr. Ryde seemed to say that the true facts were presented, but that the decision was in conflict with them. He believed that he could show in a very few words that both contentions were wrong. At page 183 of the Paper, Mr. Ryde had put the case in this way—That the Corporation of Worcester, for the purpose of supplying the city with water, chose to raise a sum of money for providing water-works and ordinary appliances for carrying water, and, having raised that sum of money, paid the interest of it, or the greater part of it, by means of a district rate. Having done this, that they were able to supply the town with water at a cheap rate—a rate so low, indeed, that only £600 or £700 was left after paying the working expenses. And that the test of the value of the occupation was what the Corporation would have to pay for a similar set of works in the market, or the sum (4, 5, or 6 per cent., according to the views of various Surveyors), which a contractor who put up the works would expect to make out of them.

Another, and he thought a right view, was to take the property as it actually existed, to look at the amount the occupier raised, and assess the occupier that amount. The main question raised by Mr. Ryde, was, whether the sum raised by the district rate or water rate was part of the occupation or not.

It might be interesting to the Institution if he stated that the origin of rating was the ancient practice of raising

money grants for the relief of the Crown. It was matter of history that, in former times, it was the custom for Parliament to make grants to the Crown, based upon the real and personal wealth of the country. There was a curious old case, in black letter, of the Abbot of Glastonbury, who complained that the Commissioners, had come down and fixed the value of the property in the occupation of his tenants, but that he was himself assessed in respect of the same property. The case being brought before the Court of King's Bench, it was decided that the rate was to be made on the occupiers only, and not upon the landlord. This decision was followed by the statute of Elizabeth, and the decision of Sir Anthony Early's case ; which was also a decision to the effect that the tenant alone was to be rated, and not the landlord—that the rate for the relief of the poor was to be on the tenant and not on the landlord. He was only insisting on these points, because they seemed to him to answer the point raised by Mr. Ryde—whether the sum of money received out of the district rate was to be taken into consideration in assessing the Worcester Waterworks.

Next came the statute of William IV.—a statute very often misunderstood. This statute enacted that no rate should be valid unless made on the annual value. These were the operative words of the statute, which went on to explain that this value was to be taken as the sum at which the property might reasonably be expected to let from year to year. This seems to have given rise to the theory of the hypothetical tenant, who was supposed to come in and alter the whole occupation ; and it had been solemnly argued that the rateable value was to be, not the real value of the occupation, but what it might, would, could, or should be. For example, there was a branch line of railway at Bristol, running alongside the docks, which was entirely

unprofitable; but an attempt was made to rate it, because it might have been used as a goods yard. That was a palpable error, and one which had often to be refuted. That it was so, would be seen on consideration, for the occupation was to be taken as it actually existed.

What it might be under different circumstances, and any presumed hardship, suffered or inflicted, was another matter altogether.

It was a fallacious argument to urge that the parish authorities had a right to have property dealt with in any particular way. A man was bound to support the poor on the value he derived from his occupation. If he lived, for instance, on a barren rock of valuable limestone or granite, and chose to leave its resources entirely undeveloped, it would not be rateable as a quarry. Again, if the owner of a house, of the value of £300 or £400 a year, chose to shut it up, and not occupy it at all, no rates were payable. He contended, therefore, that, in dealing with these matters, the right course was to consider, not what the occupation might be, but what it *was*. This being so, what were the elements to be considered in valuing this property? It appeared that the city of Worcester borrowed a sum of money on the security, not of the water-works, but of the district rate, the interest payable in respect of it being about £3,000. This liability had, he contended, nothing to do with the value of the occupation for rating purposes, but was entirely a landlord's question. If a landlord chose to pay down £40,000 or £50,000 for a property, he paid the money down and had done with it. If, instead of buying his house, he preferred to pay a rent charge, it was a landlord's question still, and had nothing to do with the value of the occupation, for he had a right to purchase the property on any terms he liked.

It might be, as in the case of the Liverpool Docks, that,

instead of the money being borrowed, it was actually raised out of the rates; but it became part of the occupation value, not because it had to be paid by yearly production, but because it was the production of property occupied. The Corporation of Worcester had chosen to borrow money on the faith of the district rate, which was a rate contributed to by every inhabitant, whether he took the water or not, and chose to supply the water at a reduced rate. This being the case, the occupation must be taken as it existed. Suppose that the Corporation, instead of providing water-works, had chosen to erect public baths and wash-houses, and to allow the public to use them for a merely nominal sum, their value must be taken as public baths and wash-houses to which access was given for a merely nominal sum, and not on some fanciful theory of cost. Would it be contended that the test of rateable value in this case was the ordinary rent a tenant would pay from year to year? This could hardly be so. For instance, the Albert Hall was built for the purposes of art and science. For promoting these objects, the hall was let at a reduced rate, and was lately rated, not on the rent which might, in one view, be its value, viz., a percentage on the cost of construction, but upon the reduced value, due to its reduced profits.

It had been argued twice with reference to the Metropolitan Board of Works, and had been held that, although the Board borrowed money secured on the main drainage rates, as they raised no money for supplying sewerage on the occupation of houses, they were not in the occupation of the rateable property. He saw no difference between supplying clean water to the top of a house, and removing it in a dirty state from the bottom, and it seemed to him there was nothing of a rateable nature in the one more than in the other. If it had been the custom, before the

metropolitan drainage assessment was introduced, for private companies to supply the drainage accommodation to houses, and to charge for it, it would, doubtless, have been contended that sewers were to be rated in the same way as the pipes of a water company were rated; but the Court of Queen's Bench had held that a sewer was not to be rated at all, for it produced nothing. If it had been productive, it would have been rateable, in proportion to its productiveness. In short, it was decided that interest on purchase-money paid out of the drainage rates was not to be taken into calculation in assessing the rateable value.

It was advantageous, in dealing with these cases, to discover, if possible, some simple rule of distinction between that paid by way of rent and that paid by way of purchase-money. For instance, the services of a rector in connection with his living were in the nature of purchase-money to earn his tithes; and a very difficult question arose, whether or not he was entitled to deduct the cost incurred in providing a curate. The Court had held that the rector was not entitled to this deduction, inasmuch as the curate was simply a substitute for the rector himself, and, as it were, part of the purchase-money of the living; and it was immaterial whether he paid purchase-money for labour or interest.

Take the case of Leicester Square, which was presented to the Metropolitan Board of Works. The Board chose to admit the public for nothing, and Leicester Square was, consequently, not a rateable hereditament. But suppose the Board had determined to charge a small sum, thus making a small profit out of it as a trading concern. In this case the Board would, it seemed to him, be rateable on that small sum. So with the Pavilion at Brighton, which he believed was purchased and maintained out of a general rate known as the "Pavilion" rate, the money

directly raised from the occupation being small. In these cases the value of the occupation surely was not what it cost, but what it produced. Interest paid in respect of purchase-money was not rent, for this reason—that it did not depend on the *locus in quo*, which was, he thought, a very good test. It was not part of the value of the occupation, because, if the occupation were destroyed, the interest would still be payable, and could still be charged upon the rates. Finally, he considered there were two distinct principles on which the property of this class might have been valued. One was to treat the purchasing price as evidence of value to the particular occupier, on the ground that the occupier need not have made or purchased the subject matter, but have hired them at a percentage of the cost. This principle would make sewers, bridges, roads, the Thames Embankment, public gardens, and parks, rateable; for, in each case, the persons acting for the public, instead of constructing the necessary works themselves, would have been willing to have them from some one else, at a percentage of the cost. This principle had, however, been decided against in the Metropolitan Board's cases which govern the present decision. The second principle was to take the property as it is, to assess it on its actual value as a productive property, and not to enquire into the considerations that led to the *purchase* of the property. This principle, he considered, the Court had adopted in this decision, a principle which must now, be followed, until this case was overruled, or the Legislature thought fit to alter the law.

Mr. F. Meadows White (Associate) said that in dealing with this case it must not be forgotten that it was the decision of a Court of Appeal which was being discussed; but, he submitted, if they looked to the facts as stated in the special case, and considered the decision as a conclusion that upon

those facts the rateable value of £540 (which was upheld by the Court) was necessarily right, that in that case the decision was open to criticism, and he, for one, would be glad if it were re-considered in the House of Lords, for in his judgment the decision would, in that case, be in conflict with many principles of the law of rating. But the decision really was limited to this—and the Courts concentrated their attention upon this in deciding between the respective contentions of the litigant parties,—that, if there existed a Parliamentary restriction upon profit, it ought to be regarded in rating the water-works, and that it was wrong to treat the water-works, under such circumstances of restriction, for rating purposes, as if they were in the possession of a hypothetical tenant under no such restrictions. With the decision, thus limited, no one could find fault. But it did not therefore follow that, under the circumstances as stated, £540 was the true rateable value. He would put this case. A Corporation supplied their town with water. The works, such as reservoirs, pumping stations, &c., "indirectly contributing" to the profit of the water-supply (to use the expression commonly used in the rating of water companies), were outside the town—in a different parish. These works occupied, it may be supposed, an extensive part of the area of the rateable land in that parish; and large sums had, beyond this, been expended upon the works. The logical result of the decision before the Meeting—considered simply as upholding £540 as the rateable value of the Worcester Water-works, and not as merely deciding between the conflicting contentions of the litigant parties upon the point submitted—would be that the rateable value of the works supposed, in the other parish, should be found and comprised in that £540, or a sum representing the casual surplus of income over outlay: in other words that it should be a nominal sum. This, it seemed to him, would be a

wrong conclusion, and never could have been intended by the Court. It had been held by the House of Lords, in the well known case of *Jones* v. *The Mersey Docks* (11 H. L. C., 443), that it mattered not that the property was occupied for public objects, and that the produce was applied to public objects, and not to private profit—that it was nevertheless rateable. Now, here, in the case supposed, the water-works were occupied by the Corporation for the public object of supplying water to the town.

Now, it would not be disputed that the water-works were rateable hereditaments. He could not, in such a case, see the answer to the argument advanced by Mr. Ryde in his Paper. Suppose the Corporation had leased these works, instead of having built them, would it have been an answer, that they chose to *give* the water to the inhabitants? He apprehended not. Suppose a Corporation took a building on lease for its public offices. Would it be an answer to say, that the rateable value was nominal of such a building in their hands, because they used it for public purposes! What was the difference if, having the duty to supply water, they leased, or acquired and occupied, (for the purpose of performing their duty), reservoirs, pumping stations, and mains? There was a well-known distinction (laid down in the cases of *Mile End Old Town* and the *West Middlesex Water-works*), in the rating of the property in the case of an ordinary Water Company, between the works, "directly" earning profit, as it was called, and those "indirectly" contributing to profit. To the former of these two divisions the judgment of the Court might well apply; not so, he submitted, to the latter. The Corporation made, as the case was put, and could make, by reason of the restriction, no profit, or but a nominal profit. But with regard to works indirectly contributing—and, indeed, it might be logically argued, with regard to all the land, reservoirs, fixed plant,

and mains and pipes, whether distributing or merely carrying,—they, having a duty to perform, required and occupied this rateable property for the purpose. Why should they not be rated? That they should, was more evident, if they took the case supposed, of the works being in a distant parish. Then at what amount should they be rated? At a reasonable amount, which a tenant from year to year would give, less the statutory deductions, usually taken as 4 or 5 per cent. on the structural value of the works. He might instance the analogous case of the School Board schools, which came before the Assessment Sessions. It was argued that these schools should be assessed at a nominal amount, because, by the circumstances of the case, the Board could only obtain by their occupation a limited sum from the school pence of the children. The Sessions held otherwise. They said the Board have a duty to perform. They have to provide schools. What was the value to them of their occupation? What would be a reasonable rent for the purpose? As a mode of calculation, a percentage was taken on the structural value. Now, in the case under discussion, there was evidence that the works had a value of this sort. It was pointed out by Mr. Ryde that the Corporation of Worcester were actually paying out of the rates, interest on the sums which they had borrowed for defraying the cost of the works.

He would make one other observation. It was sometimes urged—If the parochial authorities were rated, they would be taking out of one pocket to pay into the other. Without referring to the statutes in detail, there were many (*e.g.*, those referring to Union Rates, Police and County Rates, and the like) in which the aggregate rateable value of the hereditaments in the parish was to be considered quite apart from the question who was to pay the rates. This consideration answered the suggestion that the

property in the occupation of parochial authorities was to be dealt with differently from other rateable property, on the ground suggested.

In conclusion, he desired to say that, on the whole, he agreed with the conclusions arrived at by Mr. Ryde.

Mr. W. H. Michael (Associate) could not quite agree with all the conclusions at which Mr. Meadows White had arrived. It seemed to him that, if the decision in question were a reliable and a right one, it led to this illogical conclusion, that it lay in the power of an urban sanitary authority, owning water-works, to be rated at exactly the amount they pleased; because it inevitably followed, if they were to be rated in proportion to their charge for water (and he wished a careful distinction to be drawn between *rating* and *rental*, as it would save a good deal of confusion), they could diminish, at their pleasure, the rateable value of their works to a merely nominal sum. It appeared that the Worcester Corporation borrowed the money for the construction of these water-works, under the powers of "The Public Health Act, 1848." Under that Act, they were not empowered—nor were they by any Act up to 1855—to charge any rate exceeding 2*d.* a week, and that only when the house was declared to be unprovided with a proper supply of water. By the Act of 1858, the sanitary authority was empowered to charge for water a rate corresponding to the rate charged by any water company in the district. No power was given to the sanitary authority to charge for water for sanitary purposes—that was entirely ignored under this legislation,—and, except by agreement, there was no power whatever in the sanitary authority to charge for water for manufacturing purposes. As was well known, very large profits were made by gas and water companies, though both gas and water were used by a section only of the community;

but the Corporation of Worcester chose to charge but a small amount, and to levy a rate in aid.

What he could not but regard as the failure of justice in this case was attributable, not to an error in judgment on the part of those who determined the case, but to the imperfect statement of the case, and this, he thought, was evident in the judgment of Lord Justice MELLISH.

Under the "Public Health Act," express power was given to a Company or a private individual to hire water-works at an annual rent. He quite agreed with Mr. RYDE that, in such cases, the test of rateable value was the value to the occupier. He would refer to the section of the judgment which he thought would show that, if the matter had been properly brought before the Court of Appeal, the decision would have been entirely different. The passage in question would be found on page 60 of No. 2 Law Reports, Exchequer Division, and was as follows:—

"Now, with respect to the first question, we think that the Corporation, in making a water rate under section 93 of the Public Health Act, are bound to make an estimate of the sum they actually require for the maintenance of their water-works, and cannot legally levy a larger sum by a water-rate than the sum they so require. The 94th section makes the water-rate payable in advance, and enables the supply of any person who neglects to pay it to be cut off, and we think it cannot have been intended that the Corporation should charge any person more than his fair share of the sum which is required to maintain the water-works."

There was nothing to prove that the £651 meant the whole sum required for the maintenance of the water-works. In this lay the whole gist of the case. The appellants failed to state the sum required for the maintenance of the works, the principal item in the amount being the

interest which they were obliged to pay year by year on the capital sum raised for the construction of their works. He thought it would be quite useless to take this case up to the House of Lords, for the judgment would be the same unless the case was amended, and unless it were further shown that the £651 did not cover the whole cost, and that the expenses of the Corporation of Worcester, in connection with their duty of supplying water, was largely represented by the annual interest on borrowed money.

Mr. H. J. Castle (Member) agreed entirely with the view taken by Mr. Ryde, and thought with him that Surveyors would be placed by the decision in a position of some embarrassment. The decision, in fact, decided nothing, except the inadmissability of the hypothetical tenant principle. He perfectly agreed with Mr. Michael, for the reasons which he had adduced, that it would be useless to take this case to the House of Lords; but it was clear that it was quite open to any Surveyor who was called upon to value water-works for a corporation, to obtain a contrary decision, by submitting the case in a different and completer form.

Mr. W. Eve (Member) rose more with the desire to obtain information than to offer any. He could not himself see any very great difference between this case and that of the *Metropolitan Board of Works* v. *The Overseers of West Ham.* In that case he thought it a great hardship that the parish, not benefitting in any way by the construction of the works, should have a large area of their land put out of rating. The works were of very considerable benefit to the adjoining districts, and yet not one penny was to be paid in respect of them by the Metropolitan Board of Works. He was at a loss to understand the equity of this case. Suppose that the sewer had been constructed in

the parish before the Metropolitan Board of Works required one. Being anxious to obtain the transit of their sewage to an outlying district, what would they be willing to pay for the use of the existing work, instead of constructing it for themselves? Would not the sum they would pay be the interest on the cost, or something like the cost, of construction?

He was afraid that, until the decision in the one case was reversed, there was not much chance of getting the other altered. In the case of an outlying parish (as Mr. WHITE had put it), intersected by works, and yet not benefitting by them, it was in the power of the owner of the property benefitting from those works in another parish to fix his charges in such a way as to reduce his receipts to *nil*, and simply cover his expenses.

With regard to what Mr. E. J. CASTLE had said, it appeared to him, if that gentleman's view of the matter were correct, that it lay in the power of the landlord and tenant to determine, by a mutual arrangement, what the rateable value of a property was to be. Mr. CASTLE contended that, because the Worcester Water-works Company raised but a small income from the sale of water, in consequence of fixing the charges so low, they should be assessed only on that income. Take the case of two farms, and assume that the land of both was of equal value to begin with. Assume that the tenant of farm A gained, and the tenant of farm B lost by his farming. According to Mr. CASTLE's view, notwithstanding the fact that the two farms were of equal value, the man who lost by his farming must not be rated at an amount which assumed a wise use of the hereditament, but on the sum which he chose to make it worth by his own bad management. The adoption of such a principle would render it most difficult to value anything whatever.

Mr. J. W. Batten (Associate) said that, after all he had heard, he could not help thinking that the judges were right in the view they took of the case.

Having regard to the fact that the object of these works was the entire water supply, it would be observed that there was a rateable portion—viz., that earning rent, and a non-rateable portion—viz., that paid for by the general rate. If the water-works had been constructed wholly and solely for sanitary purposes (as originally at West Derby), they would not have been rateable; but the moment the water was used for any purpose producing revenue, if only used and paid for by one householder, on its way into the town, something was earned, to which a rate would attach.

It seemed to him that the portion of the water-works constructed for sanitary purposes could, under no circumstances, be rateable; because, in order to pay the interest on the money borrowed for the construction of the works, a general district rate had been levied, not only on those who consumed the water, but on those who did not. And here was the test that that rate was not excessive—the non-consumer did not object to the amount of the rate. The courts had, therefore, assumed the *bona fides* of the general district rate.

There was left, therefore, the other portion used entirely by private consumers, and it was only that portion which could properly be rated.

Now, if there had been two reservoirs, side by side, one supplying filtered water for household purposes, and the other unfiltered water for sanitary purposes, one costing £10,000, the interest on which was paid for by the water-rents, and the other costing £20,000, the interest on which was paid by the general rate, no difficulty as to rating would have arisen. Why, then, should there be a difficulty in apportioning the rate, because, for the sake of economy in

construction and distribution, the reservoirs were constructed as one?

Mr. C. G. Grey (Member) said it seemed to him that it was nothing to the ratepayers for what purpose the water was used. It struck him that the ratepayers had a right to have the works assessed at what they would pay for them for their use in the shape of rent.

Mr. E. Ryde felt that he had very little to say by way of reply, inasmuch as the whole, or a large majority, of those who had taken part in the debate, appeared to agree with the views which he had expressed in his Paper. The West Ham case had been referred to by Mr. Eve as analogous to the matter under discussion, but there was this essential difference between the two cases, that the West Ham sewer earned nothing whatever, whereas the water pipes of the Worcester works had a distinct earning power. The preliminary question of the rateability of works in the hands of a public body, might be taken as settled, by the judgment of Baron Cleasby, as set forth in the Paper (page 177), which stated that, "The question, in this case, is not the rateability of a public body in respect of premises occupied by them for public purposes. That question has been for some time settled, and it is not disputed that the Appellants—who are the Local Board of Health of Worcester—are liable to be rated in respect of water-works erected and occupied by them for the purpose of supplying the inhabitants with water." This judgment, therefore, put the liability of the public body in Worcester, and of all other public bodies of the same kind, in respect of these and similar works, upon the same footing, and based their rating on the same principle as would apply to a private individual or public company who erected water-

works for the supply of water—with this limitation, however, that in fixing the amount of the rate due regard must be had to any restrictions under which the operations may be carried on. The question of rateability being decided, what was the principle on which the value of this, or of any other rateable hereditament, was to be determined? There was no Act of Parliament, nor clause in an Act of Parliament, which warranted an assumption that one class of property should be rated on one principle, and another on some other principle. What, then, was the principle? It was well understood to be this, that the rateable value of a hereditament was the amount at which it might be reasonably expected to let, subject to any restrictions. To take an instance. A public-house without a spirit or wine license, must be valued at that amount only for which it would let for the purpose of selling beer—that is, the restriction must be taken into consideration. It was important that this principle should be well understood.

He might quote a few words from the judgment in the case of *Jones* and the *Mersey Docks*, which seemed to put the matter clearly, and in judicial language:—

"Where there is an actual demise of property to an occupier who pays rent to the owners of the property, the tenant (if a subject) is rateable, without any regard to the purpose to which the rent is applied. It is immaterial whether the landlord enjoys the rent himself, or is obliged to pay it away as interest to mortgagees, or even (as is the case with the tenants of Crown property), pays it into the consolidated fund, or the privy purse of the Sovereign. The occupier in each case is rateable. And if the matter were now for the first time to be determined, without reference to decisions, it would seem that where the owners of the property are themselves in occupation, and receive the value, the amount of which is measured by the rent which the

hypothetical tenant would give, the purposes to which that amount is applied ought to be as immaterial as if there had been a real demise at that rent; and the occupiers (if subjects) ought to be rated, whatever be the object for which the property is occupied, unless some special enactment exempted them."

To illustrate the principle, take the case of a house let at £100 a year, and worth, in fee simple, 20 years' purchase, or £2,000. The rateable value of that house would be £100 a year. A similar house might be the freehold of one individual, but let at a ground rent of £5 a year, which would be all the income that the freeholder would get out of it. The lessee, say for 99 years, would get the balance or £95, but the rateable value would still be £100 a year. A third house in the same street at £100 a year, might be the property of an owner who had purchased the property for £2,000, half of which he had borrowed at 5 per cent. The interest would amount to £50, leaving only £50 as his annual income from the property. In this case, as in the preceding, the rateable value of the property must be £100 a year, and no other sum.

Having thus far cleared the way, he might proceed to apply the principle to water-works. First, the Corporation, if they had had the funds (which sometimes happens), might have employed them in creating those water-works, or they might have done what the Corporation of Worcester did—borrow £48,000, and thus create the works. In the one case, the loss of the interest which they could otherwise have made from their money, would be equivalent to the rent at which they would sit for the works; or, in the other case, the interest they would pay for the money borrowed would equally represent rent.

It being for the public good that the town of Worcester

should possess water-works, Parliament had directed that the cost of providing such works should be charged to the general district rate, to which every one contributed.

If the rateable value of the three houses referred to was £100 a year, that being the rent which they would command in the market, then the rateable value of the Worcester Water-works was the rent which they would command in the market, with the restriction of putting no greater annual burden upon the inhabitants of Worcester than they now bear. Baron Cleasby, in his judgment, said: "The question is whether the rateable occupation is to be measured by the profits actually derived from the occupation, or by the profits which might be derived from it by a person or company who occupied the works solely for the purpose of profit." What he wished to call attention to was, that such a profit as was referred to was not rateable at all—it was the rent that was paid for the hereditament, not the profit made out of the hereditament, that was rateable; and it seemed to him that the judges had not had the real question clearly before them. The profit which a man made by carrying on business in premises could not come into the rateable value of the premises. Such a profit could arise only after the rent was paid, which rent was the rateable value. Now, on page 179 of this Paper, these words (quoted from Baron Cleasby's judgment) would be found: "and it would be strange to rate them (*i.e.* the public body), not in respect of what they can properly enjoy, and do enjoy, but in respect of what they cannot properly enjoy, and do not enjoy." The enjoyment of the property, in this case, was the use of the water-works which the Corporation had to the fullest possible extent of their annual value.

One observation he might add. The thing must be a

corporeal hereditament, as a lawyer would say, to be rateable, and a water-works was a corporeal hereditament. The water itself was not a corporeal hereditament.

In conclusion, and in his capacity of CHAIRMAN for the evening, he might observe that both the Paper and discussion had been confined to the consideration of the facts as they presented themselves to lay minds, and if the conclusion arrived at by some of the speakers conflicted with judicial decisions, it was, he ventured to believe, because those decisions, though strictly in accordance with such facts as were before the Courts, were based upon a portion only of the whole facts of the case.

The Meeting then adjourned.

No. 75.]

# OYSTER BREEDING.

By HOWARD MARTIN, Member.

*Read at the Ordinary General Meeting of the* Institution of Surveyors, *April 8th*, 1878.

THE PRESIDENT IN THE CHAIR.

It has been suggested to me that the small apparent connection of the subject for discussion this evening with the professional occupations of Surveyors renders it desirable that I should preface my Paper with some sort of apology for introducing such a subject.

I think, however, I shall be able to show that oyster breeding may very materially affect the values of the creeks and small inlets of the sea which form a part of some of the estates which are, or may be, under the management of Members of this Institution; indeed, my own information on the subject has been obtained in the discharge of professional duties. It appears to me, therefore, that whatever excuses may be rendered necessary by the imperfections of my treatment of the subject, none are required for introducing it to your notice.

I think I ought, before going further, to say that I do not propose to deliver a scientific lecture on the natural history of the oyster, nor on the particular branch of it which I have taken for my subject this evening. I cannot pretend to the necessary qualifications for such a task; but I have been fortunate enough to be personally concerned in an experiment in oyster breeding which proved

remarkably successful, and the facts with which I became acquainted in the course of that experiment were interesting enough to myself to lead me to believe that a short account of them might be acceptable to the Members of this Institution.

The great scarcity, and consequent high price, of oysters during the last few years has strongly attracted the attention of the public to the causes of this scarcity, and to various means by which some of those causes might be removed. One such cause, no doubt, has been the comparative failure, in many places and for several years in succession, of oyster breeding, and there is reason to believe that the deficiencies of the natural breeding places may be, to a great extent, supplied by artificially enclosed ponds, prepared for the purpose, in which the parent oysters may breed, and the "spat," or young oysters, may be protected from some of the dangers which prove fatal to them elsewhere. I am aware that some authorities on the subject believe that, from the absence of necessary climatic and other conditions, this source of supply cannot be calculated upon with certainty in this country, but there is very good ground for a more hopeful opinion. At any rate, a sufficient measure of success has attended experiments already made, to give them a practical interest, not only to naturalists, but to all who are interested in the food supply of the country, or in the value of our oyster fisheries, and of those parts of our coast which may be suitable fields for oyster breeding operations.

No created being probably appears to the unscientific eye more plain and straightforward, and less complicated than the oyster, but, probably, there is no living thing whose whole life is more a matter of controversy. I hardly think it possible to make any statement about his birth, life, or death, his habits or his anatomy, which some one would not be found to promptly and authoritatively contra-

dict. I have endeavoured, therefore, to get at the truth by a comparison of the best sources of information to which I have had access, and I wish it to be understood that I am about to give the result of such a comparison and am not daring to pronounce authoritatively on points on which so many "doctors" (of all degrees of learning and authority) "disagree."

Most of us know well by personal experience that the scarcity and consequent dearness of oysters are unmistakeable facts. Physiologists tell us that oysters, as an article of food, supply most valuable means of repairing the waste caused by mental overwork; but it is a long while since any overworked sufferer of moderate means could resort to a diet of oysters as a remedy, without serious doubts whether the gain would be sufficient to leave any profit on the cost. A few figures, however, which will supply a more definite means of realizing the general scarcity in the market, may not be uninteresting.

It is stated in the Report of the Irish Commission on Oyster Culture that, in 1855, "natives" were sold for 41*s.* per bushel, and in 1870 at £10 2*s.* per bushel; and "commons," which in 1855 fetched 3*s.* 10*d.* per bushel, in 1870 fetched from 10*s.* to 18*s.* per bushel; the supply having steadily decreased during the last ten or twelve years, while the demand has largely increased.

Witnesses from various parts of our coast stated in evidence to the Select Committee on Oyster Fisheries, which sat in 1876, that the supply had decreased in the most marked manner, and that, in consequence, the price, which was 3*s.* per tub in 1852, had risen to 45*s.* per tub in 1870.

One witness from the west coast stated that, while in the year 1863 a merchant was able to buy 8000 tubs of oysters at from 4*s.* to 14*s.* per tub from fisheries near Falmouth, in 1869 he could only obtain 853 tubs at 45*s.* per tub from the

same place; and that formerly about twenty merchants were accustomed to deal in oysters from those fisheries, while in 1876 not more than two did so. The same witness stated also that, whereas twenty years ago a man and boy could with ease obtain in one day five or six tubs of oysters on a certain fishery on the same coast, at present they could barely get 100 oysters in the same time. Not to unnecessarily multiply examples, however widely the numerous witnesses before that Committee differed on other points, they all agreed that so serious a deficiency in the supply of oysters existed as to make the discovery and removal of the cause or causes a matter of national importance.

Opinions as to the cause of this scarcity are of the most conflicting character.

It is said that, while oysters have the most extraordinary powers of reproduction—one oyster emitting at one spatting nearly two millions of embryo oysters—a very high temperature is essential to the development of the "spat," and that, our summers having been for many successive years decidedly cooler than the summers of the good old days when oysters were cheap and plentiful, the annual crop of young oysters has failed us, and will not be restored until we get once more a succession of old-fashioned summers.

The balance of evidence does not appear to me to support so gloomy a view. There is no doubt that a combination of favourable conditions is necessary to secure the life and development of oyster spat, and that an unusually low temperature, while it is floating, or near the time of its attachment, will probably kill it, but it is by no means proved, on the other hand, that a very high temperature will ensure the production or the life of the spat, or that it may not be emitted and thrive at a moderate temperature. For instance, Mr. Fell Woods mentions a great fall of spat in 1868 which occurred while the temperature ranged between

57° and 68°: Captain Johnson obtained a fall of spat at Newtown in the Isle of Wight in 1874, while the temperature ranged between 58° and 60° from the time it was first observed floating until its attachment. In 1875, at the Oyster Fisheries in Brading Harbour, a great fall of spat was obtained in the middle of June and early part of July, when the weather was very far from being unusually warm, and last year, at the same place, another remarkable fall of spat was obtained at about the same date under the same circumstances.

It appears, therefore, that our summers are still hot enough for oyster breeding, if we can secure other necessary conditions, either by the protection of the parent oysters and the spat in enclosed ponds, or by giving the parents a fair chance of breeding on their natural beds,—a chance which in many cases has been denied them. It is a noteworthy fact that those oyster beds which are naturally good breeding places are rarely good fattening grounds, and that good fattening grounds are seldom places where it is possible to breed a supply of young oysters. It is necessary in consequence that oysters should in most cases be taken from their natural breeding places and laid on other grounds to be fattened for consumption. Very large quantities of oysters have been year after year removed, for this reason, from grounds on which they would probably have bred largely before they have reached the age at which they spat, and laid down on grounds where they either do not spat, or the spat does not attach itself, and in this way their reproductive powers have been wasted.

Moreover, there have been many instances of natural beds having been so greedily dredged as to be actually destroyed entirely; and many where the removal for sale of oysters of all ages and at all seasons has so diminished the beds as to render them worthless.

It is said, too, that when no "close time" was enforced on the public oyster beds, oysters were frequently dredged up for sale when about to spat, and emitted their spat in great quantities on the decks of the boats in which they were removed, thus wasting what might have developed into many millions of oysters. It is to such causes as these, to the short-sighted selfishness which, all over the world, "kills the goose which lays the golden eggs," and does not rest until it renders extinct every saleable animal on which it is allowed to work its will, that it seems to me we must look for the causes of the scarcity of the oyster, and not to any uncontrollable cause, such as an alteration in the temperature of our planet, or of our country, even if such an alteration really exists.

The breeding places of the oyster may be divided into four classes, viz :—

(1) Entirely natural beds, situated generally more or less in the open sea (such as those in the Bristol or British Channels, or in the North Sea) where no work is done to protect or assist the reproduction of the oysters.

(2) Natural beds (such as those in the various creeks and bays on the coast of Essex and Kent), where breeding is assisted by what is called "cultivation," *i.e.*, the clearing of the ground from mud, weeds, and the living enemies of the oyster, and the laying down of shells or (cultch, as it is called), and other suitable collectors to which the spat can attach itself.

(3) Foreshores, on which collectors of various kinds are placed to receive spat washed to them by the tides from natural or partly natural beds in the vicinity, such as those at Ré, Oléron, Arcachon, and other places in France.

(4) Enclosed ponds, in which the parent oysters are placed to spat, and in which the spat is allowed to remain until it is large enough for removal to the ordinary laying

grounds, such as those at Brading, Cowes, Hayling Island, Marennes, and elsewhere.

As has been remarked before that the supply from the natural and partly natural breeding places has diminished considerably during the last few years, and the use of artificial breeding places has been too recently introduced, and not sufficiently successful (in this country, at any rate), to affect the supply; but there is good reason to hope that, in the future, it may come to be a very valuable addition to the natural sources.

Oysters are hermaphrodites, and it is now pretty well established by microscopical observations that they are self-impregnating. Indeed, apart from the evidence of the microscope, the probabilities of the case incline decidedly to that view. Oyster beds are in most cases exposed to the action of the wind and of strong tidal currents; and it is difficult to believe that spermatozoa could be carried by the action of the water (and they must necessarily be so carried if oysters be *not* self-impregnating) from one oyster into the other with sufficient certainty to secure the regular and certain impregnation which undoubtedly occurs.

Oysters are said to have been known to spat when between one and two years old, and there is no doubt that they frequently do so between the ages of two and three years.

The time of spatting varies, according to the season and situation of the oyster beds, from May to September, but June and July are probably the months in which spatting most usually takes place. Some weeks before the parent oysters emit their spat, the eggs developing within the reproductive gland give it a creamy appearance. When in this condition, the oysters are technically called milky, and are not, of course, fit for consumption; though removing them from their beds to others at a distance of several days'

journey does not appear more injurious to them at this time than when in their ordinary condition.

When the eggs advance a stage, and leave the reproductive gland to lie in the mantel, the oyster becomes what is called "white sick;" and the eggs in that position develop into shelled embryos, in which state they are called "white spat."

They afterwards develop a ciliated cushion, and a sort of pad or funnel-shaped collar, and having gradually reached a darker colour, they at last become what is called "black spat,"—the perfect larval form of the oyster,—in which state they are ejected by the parent.

It was formerly supposed that the "black" and "white spat" were of different sexes, but microscopical observations have conclusively proved that those names merely describe different stages of development of the same thing.

I have never been so fortunate myself as to see an oyster actually emit its spat. Mr. Buckland, however, has done so, and he describes the oyster as expelling the spat with a sharp clap of the shells in a little cloud like a puff of steam from a locomotive. The spat, directly it leaves the parent, rises to the surface, and swims about, propelling itself by means of the cilia with which it is furnished.

Probably the further development of the spat changes its specific gravity, and it sinks involuntarily; at any rate, after a certain time the spat does sink, and attaches itself to any clean and hard surface that may be accessible to it. It is not certainly known whether the spat has any power of choice in the matter of its attachment, or whether it adheres involuntarily to the first suitable surface with which it is brought into contact after it has arrived at the necessary stage of development.

For my own part, I am inclined to think that the former view is the correct one, for I have noticed that spat appears to

show a decided preference for certain kinds of "collectors" (as the articles to which spat attaches itself are called), and to the *under* surfaces of collectors, in positions in which it is hardly likely that the spat would have been involuntarily brought into contact with them. It is probable that the adhesion of the spat to the collectors is caused by the secretion which enlarges the shell as the spat develops, acting as a sort of cement, and "setting" on to both shell and collector.

I have been unable to form any idea as to how long the spat floats in freedom. Spat was observed floating last summer in the breeding ponds I shall presently describe, about ten days before any was observed to be attached to the collectors, and some of the first spat observed floating being placed in a glass aquarium lived for sixteen days, and died without attaching itself at all. But I do not think any conclusion can be drawn from these facts. It is obviously impossible to prove that the spat first observed floating was the same as that first observed attached, or indeed that that particular spat was ever attached, or how long the parent oysters continued spatting. Millions of spat no doubt never succeeded in attaching themselves at all, and a pond some acres in area affords no means of tracing the spat from the parent to the collector, which might, however, possibly be done in a properly arranged aquarium. The spat placed in the aquarium evidently required certain conditions to enable it to attach itself which were not present, and its conduct therefore throws no light on the point.

During the time the spat is floating, great quantities are eaten by shrimps and small fish, and carried by the currents or the action of the wind to places where, finding no suitable surfaces to which to attach itself, it perishes, or where its attachment is of no benefit to the owners of the bed from which it started; and a sudden considerable fall of temperature may often kill nearly the whole of it while it is floating.

When the young oyster is securely anchored, however, his dangers are by no means all past.

The human preference for oysters as an article of food is shared by crabs, star-fish, and whelks. Crabs have been observed tapping with their claws at the edges of the shells of well-grown oyster spat until, having chipped them away, they could introduce a claw and wrench the shells open. After the oysters have grown too strong to be treated in this way, the crabs show great acuteness in discovering and breaking into any the shells of which have been weakened by any accidental injury. They are especially destructive in this way to young oysters whose recent removal from the collectors has left (as is often the case) a weak place in the shell where the attachment has been broken away. The five-fingered star-fish and the dog-whelk, or whelk tingle, are both also very destructive to oysters in many fisheries. The former is said to embrace the oyster with its five arms, and wait patiently until hunger or a sense of suffocation compels the oyster to open its shells, and then, by promptly inserting a finger, to prevent their closing, and make a meal of the oyster at its leisure. The latter is said to perch itself on the upper shell of the oyster, and, having drilled a hole through it with its hard tongue, to kill the oyster with a drop of acid passed through the hole, a much more scientific and less brutal method of committing the crime than that adopted by the "five-fingers." In addition to their living enemies, oysters are, in some fisheries, frequently killed by sand or mud accumulating above them, or by the chilling of the water in which they lie by the passage of melted snow over the beds in times of thaw. It is not astonishing, therefore, that the natural productiveness of the oyster—great as it undoubtedly is—is not sufficient to meet the enormous demand made upon it for the supply of the markets, unless, in the first instance, the reproductive powers of the parents

are allowed fair play by the enforcing of proper restrictions on their removal from breeding places; and, in the second, unless great care be bestowed on the protection of the growing oysters when the parents have produced them.

In fisheries under cultivation, the young oysters are carefully removed, when about nine months old, from the collectors to which they are attached, and placed in the "laying grounds" to grow. Being very light, they are very liable to be carried away by the force of the tide, especially if a little sea-weed happens to grow upon the shell, and, acting as a sort of buoy, helps to float them; and, as I have said before, they are also at this time particularly liable from the weakness of their shells to be injured by crabs. It is necessary, therefore, that they should be protected in some way, and in some fisheries they are placed in small ponds, prepared for the purpose, between high and low water mark; and in others (especially in France) they are placed in trays in large boxes, moored in suitable places, and fitted with gratings to admit the water, and exclude the crabs.

Where the spat is at all thickly attached, and is not artificially removed from the collectors, the young oysters, as they grow, gradually "shoulder" each other into a vertical position until they break the attachment and free themselves, or rather each other. But their growth is hindered and their shape usually spoiled in the process.

At about a year old, or a little older, the young oysters (or brood, as they are then called) are saleable to the proprietors of those growing or fattening grounds on which oysters seldom or never breed, and which require, therefore, to be kept supplied with young oysters from breeding grounds on which they do not fatten well.

They are supposed to reach maturity and the best age for consumption at five years of age; but no doubt many thousands are annually eaten when very much younger.

There is no doubt that many oysters spat when two years old; but I have not been able to ascertain whether they usually spat every year, or, if not, at what intervals. There is evidence, however, that some oysters do *not* spat two years in succession; and if, as is possible, they only spat twice before they reach the age when most of them are taken for consumption, that fact seems to render it especially important that none should be removed from natural breeding places until they have reached an age at which they may be expected to have spatted once, at any rate.

I believe that the first attempt to breed oysters in enclosed ponds was made in France. The first in this country was made by Mr. Hart, at Hayling Island, I believe, about the year 1865.

Breeding ponds have been laid out and stocked with parent oysters nearly every year since that date at the fisheries at Hayling Island, with varying success; and the Isle of Wight Oyster Fishery Company has also laid out and stocked breeding ponds at its fisheries near Cowes, and has, on more than one occasion, succeeded in obtaining a good fall of spat.

Breeding ponds were also laid out at the Brading Harbour Oyster Fsheries, I believe about the year 1868, but with little or no success until Major Boyle, at that time the lessee of the fishery, succeeded in obtaining a very remarkable fall of spat in 1876, a success which was repeated in the following year under the management of his successors. There are one or two other fisheries on the English coast where breeding in enclosed ponds has been attempted, but not, I believe, on any large scale, or with any great measure of success.

On the whole, it may be said that, while there are numerous instances of the success of this mode of breeding in this country, successes have been too widely separated by

repeated failures to establish it as yet as a trustworthy source of supply; but it must be remembered that much had, of course, to be learnt by those who not very long ago made the first experiments in this direction, and there is now reason to hope that the principal causes of previous failures have been discovered, and may be, in future efforts, avoided.

When ponds were first laid out for breeding oysters, it appears to have been almost universally believed that the great essential to success was to obtain "heat and tranquillity" in the ponds; and to jealously close every aperture by which water could escape from them, lest the floating spat should escape with it. The ponds were in some instances made shallow, so as to secure the raising of the water in them to a higher temperature, and in various ways much trouble and money were expended in endeavouring to secure these supposed necessary conditions of success. But success was not often the result. In some cases, the parent oysters spatted prematurely, and the spat never appeared to live at all. In some cases it lived a short time, but failed to attach itself to the collectors, and success appeared to be the exception rather than the rule. After some considerable experience of these repeated failures and rare successes, it occurred, I believe, to several experimenters in different fisheries at about the same time that the policy that had been pursued was wrong. There was no doubt that the breeding of Oysters had managed to get itself successfully accomplished in open beds, where the maximum of heat and tranquillity must be much less than that often obtained in enclosed ponds, in which attempts to get a fall of spat had entirely failed. It was obvious that the confinement of comparatively small quantities of sea water of a small depth, even for a short time, without renewal, under a hot sun, must bring it into a very unnatural condition, probably very unsuitable to such delicate living organisms as oyster spat, and it was

evidently better to lose even a few millions of the floating spat in renewing the water than to kill it all by allowing the water in which it was to exist to become unfit for it. On these grounds, the mode of procedure was very materially altered, with a view of producing in the enclosed ponds laid out for breeding conditions as nearly as possible like those under which oysters breed in their natural breeding places.

An experiment at Brading Harbour, made by Major Boyle on these principles, in 1876, proved entirely successful. A pond, about 2¼ acres in area, was stocked with about 1,200 parent oysters, and a quantity of hurdles, faggots, and slates, as collectors. From the time of the placing of the parent oysters in the pond, the water was freely renewed, even while it was full of floating spat, and a very remarkable fall of spat, amounting to about 15 millions, was the result. This spat continued remarkably healthy up to November 1877, when it was successfully removed from the pond.

At the end of the year 1876, the fisheries at Brading Harbour passed out of Major Boyle's hands, and the purchasers decided to repeat his experiment in the following year, and were fortunate enough to repeat his success. I am able to describe the operations of 1877 from my own observation. Two ponds on the edge of Brading Harbour, and nearly adjoining that in which the fall of spat just referred to had been obtained in 1876, were already partly constructed; embankments completing the enclosures were formed about 6 ft. high, about 4 ft. in width at the top, and with slopes of about 1 to 1, and faced with faggots pegged securely to the slopes to protect them from the wash of the water. When enclosed, the two ponds were about 2¼ and 1½ acres in area respectively. So far as practicable, all soft mud was removed from the bottoms of the ponds, and replaced with chalk or shingle. We had, however, deferred the commencement of the work until

too late in the season to allow of our spending enough time over this part of it to execute it thoroughly. Stout wires were strained across the enclosures on stakes driven into the ground in parallel rows about 6 ft. apart, the wires being kept from 1 foot to 2 feet above the bottoms of the ponds, and boughs were laid across these wires, and securely attached to them, so as to make, when the water was admitted, a sort of floating canopy of twigs about 2·0 ft. below the level of the surface of the water. In a portion of each pond, plain roofing tiles, instead of boughs, were hung in pairs over the wires in such a manner that one end of each tile rested on the bottom, and one end on the wire so as to form a row of little tents, as it were, open at the sides. A quantity of hurdles and some slates were also laid on the lower part of the slopes enclosing the ponds.

The boughs, tiles, hurdles, and slates were all intended for collectors, to which any spat emitted in the ponds might attach itself. It had been found that boughs and hurdles, although from their irregularity of shape they are likely to produce bad shape in the spat attached to them, had one excellent quality as collectors, *i.e.*, that the bark could be peeled from the wood with the spat upon it, and so, when the proper time came, the spat could be removed from those collectors without injury. On the other hand, a large proportion of spat attached to stones or slates had been killed in removal. But few slates, therefore, were placed in the ponds, and all the tiles were coated with a mixture of clay and cement which could be peeled from them in the same way as the bark from a hurdle.

Across the centre of each pond a wide gangway was left for the reception of the parent oysters, so that, in the event of the attachment of any spat, the parents could, if necessary, be removed from the pond without disturbing the collectors.

The ponds were each fitted with pipes (the openings to

which were controlled by screw sluices) communicating with the water in the adjoining harbour at half tide; in each case one pipe was fixed on a level with the bottom of the ponds, for use in completely filling or emptying them, and another a little below the level of the surface of the water in the ponds when full. A similar set of pipes and a sluice were fixed between the ponds, so as to allow of the passage of water from one to the other if required. About 25,000 parent oysters were placed in the smaller, and about 35,000 in the larger pond, in the last week in May; and the water was then gradually admitted until it reached a depth of about 3 ft. 6 in. From that time a certain quantity of water was allowed to escape, and to be replaced by the rising tide in each day—in fact, so far as possible, a gentle current was kept up by this means, and by the use of the communication between the ponds. On the 25th of June spat was first observed floating, and on the 4th July some was discovered attached to a tile. For about ten days after this the process of attachment went steadily on, until almost all the collectors in the ponds, but more especially the tiles, were densely covered with the little oysters, which have grown and thriven well from that time to this. I have on the table, specimens which are fair samples of the collectors throughout the ponds.

I am not aware of any previous instance of large falls of spat having occurred two years in succession in the breeding ponds of any other fishery; and the fact that this has occurred in this instance, though as yet it has hardly been proved to be the result of the change of method I have described, is, at any rate to some extent, evidence in favour of it.

It is worthy of remark, also, that the weather either in 1876 or 1877 was not by any means exceptionally warm at the time of the floating and attachment of the spat; nor, I

believe, was a fall of spat of any consequence obtained in those years in artificially enclosed ponds in any other fisheries. Considerable importance was attached by Mr. Mursell, the very intelligent foreman of the fisheries, to the selection of parent oysters from fisheries far south; because the oysters arrived earlier at a very advanced condition of "milkiness" at those fisheries than in colder latitudes, and consequently might be expected to spat early, at a time when favourable weather is most likely to prevail.

I am quite unable to give an opinion as to the truth of this theory. I can only say that, in this instance, the parent oysters, purchased to stock the ponds at Brading, when they reached us were so far advanced in milkiness that we were somewhat afraid that they would spat before we could get them into the ponds, but that, as a fact, very few were injured by the journey, and they did certainly spat at the very time that we desired that they should do so.

It was observed that the spat appeared to show very decided preferences in attaching itself: a much larger proportion being found attached to the tiles than to the other collectors, and to the under than the upper sides of the tiles, I am inclined to think that this fact tends to disprove the theory that oyster spat becomes involuntarily attached to the first suitable surface with which accident brings it into contact after it has reached a certain stage of development.

We made several careful estimates of the quantity of spat attached to the collectors; the lowest set the number of young oysters in the two ponds at forty millions, and some reached a considerably higher figure. Taking the lowest estimate, and allowing 50 per cent. for losses by death up to and during the removal of the young oysters from the collectors at about a year old, (a percentage above the average), twenty millions would be left, which would then be worth about £1 per thousand, or £20,000. Against the

probability of obtaining such a sum, must be set the possibility of some accident, or of very severe cold during the first winter, making great havoc in the ponds, and destroying all or most of the infant oysters; but the risks of such catastrophes are by no means out of proportion to the profit to be gained in the event of their being safely avoided. I am informed that, as a matter of fact, the spat obtained in 1876 has been this autumn removed from its pond, and detached from the collectors with a percentage of deaths estimated at about 10 per cent.

The cost of the construction and stocking of the ponds was £336 4*s.* 4*d.* Part of the necessary embankments was completed when we commenced the work, but the amount saved in that way did not amount to more than £50 or £60; and I think £400 may be taken as a sufficiently accurate estimate of the entire cost of the work from the beginning; an outlay almost ridiculously out of proportion to the value of the results obtained.

The land occupied was merely barren foreshore, almost, if not quite, worthless for other purposes, though it is difficult to say what its rental value might become if future experiments prove—as I think there is good reason to hope that they will prove—that a repetition of the results of the last two years may be calculated upon with tolerable certainty.

If oyster breeding in enclosed ponds ever becomes an established business, and, for my own part, I believe it will, the foreshore of those parts of the coast which are suitable fields for its operations will become of enormous value, and (what would be a benefit of far more importance to the general public) we may live to see the day when oysters will cease to be an article of food available only, by reason of its price, for millionaires or prodigals.

Mr. R. C. Driver (Member) begged to propose a vote of thanks to Mr. Martin for his excellent Paper, which could not fail to interest all who desired information on the subject, and, moreover, was valuable for future reference. He had, himself, been professionally concerned with Mr. Bird, of Cowes, in the Brading Harbour Fishery case, and had formed a decided opinion—an opinion which the Paper had gone far to confirm—that a large fortune might be made out of those oyster beds, or parks, as they were now called, when the sites were well selected. The part of the coast on which this fishery was situated being more than ordinarily protected from the action of frosts, and from the contamination of sewage, the oyster beds had proved a very great success, and were well worth a visit. It was surprising to see how much had been done with the small area of ground occupied by the beds at Brading. He was sorry Mr. Bird was not present this evening, as he was thoroughly conversant with oyster breeding, and could have given much useful information.

He was acquainted with the oyster beds or parks on the Medina near Cowes. It was there found that small ash poles were the best things to put into the ponds for the spat to attach itself to, the young oysters being entirely detached therefrom—the bank assisting in this. Tiles, also, were very good for the purpose, and hurdles, from which some of the sticks had been removed, so as to loosen them. The number of small oysters that would attach themselves to one hurdle was extraordinary. The poles or hurdles could be easily taken out and inspected, to ascertain the quantity and state of the oysters, and, if necessary, easily replaced.

The age of an oyster was ascertained by counting the "*rims*" on the shell, somewhat in the same manner as the age of a tree—when felled—was estimated by counting its "*rings*" from the centre to the bark. He had always

considered that he who first ate a raw oyster was a bold man.

Mr. D. Watney (Member) had much pleasure in seconding the vote of thanks. He would be glad if Mr. Martin would give a little further information as to the cost of stocking the ponds. He understood Mr. Martin to say that the two ponds referred to were constructed and stocked with something like 60,000 parent oysters for about £400. This seemed a very small outlay for obtaining so enormous a yield, but the disproportion was, no doubt, easily explained. The subject was one which might possibly become of great importance to Surveyors, and Mr. Martin was entitled to the thanks of the Members for having brought it under the notice of the Institution.

Mr. W. Fell Woods (Visitor) said that not being a member of the profession he only joined in the discussion at the request of Mr. Martin, and as having been for many years interested in the so-called artificial culture of the oyster. He proposed merely to make a few comments. He would first call attention to an error. Mr. Martin had spoken of the first experiment in England having been made at Hayling, in the year 1866. This was not so. The earliest successful attempts with which he (Mr. Woods) was acquainted were two made in the east of England in 1863 and 1865. Again, he understood Mr. Martin to say, when alluding to the success at Brading in 1876 and 1877, that he believed that in neither year had there been a spat elsewhere; whereas the fact was that in the former year there was a very large spat (24 millions) in a pond at Hayling.

With reference to the theory of heat and tranquillity, started by Mr. Frank Buckland and Mr. Wiseman, Mr. Martin had quoted his (Mr. Woods') published experi-

ence, and he would be happy to furnish the Institution with some copies of a pamphlet in which would be found further evidence that great heat was not essential, and that it did not ensure success.

In confirmation of the statement of the early age at which oysters might spat, he could instance oysters bred by himself which, before removal from the hurdles, at rather less than a year old, were found full of black spat. But he felt that this was very exceptional, and ought not to be made the ground of any inference in favour of the removal of young oysters from public beds. The damage to oysters by the five-finger, referred to, was partly effected by that more refined method which had been attributed to some other enemies; its stomach was pressed between the valves of the oyster, and thus a poisonous secretion was applied, by which the prey was weakened, and the star-fish enabled to introduce a finger, and to remove the occupant of the shells.

A belief had been expressed by Mr. Martin, founded on the position in which spat was discovered, that it was capable of exercising a choice. Such had been his own impression formerly, but he now believed its attachment was involuntary. Its movements were self-regulated, but not so its attachment. The under surfaces of collectors were necessarily, for the most part, the fittest for attachment, as being free from slimy deposits; whilst the collectors being usually at a higher level than the bottom, contact was more probable with their under surfaces. It was a curious fact that in one position only was attachment and development secured; but upon this matter he must refer any who might feel interested in the question, to pp. 17 and 18 of the pamphlet.

As to the period when the method of *designedly* allowing the entrance and exit of water whilst spat floated, was first successfully employed, it occurred under the direction of

Colonel Tomline, in the Orwell Park beds in 1868, when he judiciously enjoined the closest possible adherence to nature. It was that instance which confirmed his (Mr. Woods') own original impression in its favour. This course had not, however, always been pursued with success.

He would like to know whether any kind of strainer had been used at the sluices, either in the admission or extrusion of the water. He thought he remembered having seen some canvas so employed at Brading on one occasion.

Mr. N. V. Squarey (Visitor) would like to contribute a few words to the discussion. During last autumn he was at Baltimore, in the United States, and while there sought an opportunity of visiting one of the many large oyster establishments in that city, where he saw from 250 to 300 men employed in opening oysters and putting them into tins for exportation as fresh oysters. The establishment also included a large kiln for converting the shells into lime. This single firm put up something like 20,000 of these tins a day, each tin containing about 3 dozen of the largest and finest oysters, or about 7 dozen of the smallest. He brought home with him a case containing about 6 dozen of these tins, and he believed they were about the first brought over to this country. They had been kept in the ice house on the voyage. He sent some of the oysters to the head of an establishment in Billingsgate, who, though previously inclined to regard them with disfavour, merely because they were in tins, after tasting and appreciating them, predicted an enormous trade. The tins had to be kept in a low temperature, and under these conditions were sent into all parts of the interior of America. The price of the oysters was about 3 dollars a barrel, each barrel containing from 700 to 800 oysters. He had read an article in "Scribner's Magazine," which was corroborative in many respects of the

information he had received that evening. If he recollected rightly, it stated that there were years when there was a copious supply of spat and no result, and other years when much of the spat developed. One of the conditions necessary for obtaining a good crop of oysters appeared to be a perfectly clean, good bed (he referred to a native bed), free from slime. The presence of slime appeared to be fatal to a deposit of spat.

In America there were to be seen oysters of every variety of shape, shell, and size, the varieties being due, very largely, to the conditions by which the oysters were surrounded in the period of their growth.

The consumption of oysters in America was enormous,—estimated at 50 millions of bushels per year,—and the quality, to his mind, was perfect.

Mr. W. J. Beadel (Member) conceived that Mr. Martin had prepared this Paper for the purpose of creating an interest in the culture of the oyster, and of showing that oyster culture represented what might before long become an interest of very great importance, and one in which a large amount of capital might be embarked, as soon as the conditions necessary to success were more thoroughly understood.

He had listened with interest to Mr. Squarey's observations, but feared he could not endorse his encomiums on the American oyster—at least, if he referred to the species known as the "Blue-point."

An oyster crop, like a crop of fruit or corn, thrived best in particular localities, and in these localities a certain measure of success might always be looked for; though, even under the most favourable circumstances, there was very great doubt as to whether or not a crop of spat would be obtained.

The effects of temperature had been alluded to, but he

had not been able to gather, either from Mr. Frank Buckland's reports, or from the observations of Mr. Wiseman, who had an extensive practical acquaintance with the subject, that the supply of spat depended altogether either upon temperature or on any other yet known condition, though it seemed probable that temperature was not without considerable effect upon the spat in its earlier state. No arrangement of hurdles or faggots would secure the fall of spat or its development under adverse climatic influences, and human ingenuity had not yet succeeded in counteracting those influences; although, as at Brading Harbour, it might do something towards modifying them, and increasing the probability of obtaining a crop.

In this view of the matter, and looking to what science might be able to achieve in the future, it was important that Surveyors should study this question as referring to an element of latent value in many properties bordering on the estuaries of rivers, or upon inlets of the sea, which were frequently looked upon as worthless. He had himself met with instances, particularly in cases of copyhold property, where the difficulty was to get anybody admitted to them. He had actually known men paid to take copyhold admissions to oyster "layings," the letting values of which, within 15 years of these admissions, were raised to £50 each by careful and skilful culture.

It was no doubt true that oysters were hermaphrodite, and, having regard to that peculiarity, it was very possible that the spat selected certain places for attaching itself, so as to avail itself of the conditions most favourable to its development.

Mr. T. M. Gepp (Associate) had seen something of the cultivation of oysters in the county of Essex, but felt that, in common with others, he had still much to learn on the

subject, and was grateful for the information furnished by the author of the Paper. As steward of manors which included several considerable oyster "layings," he had been compelled to seek for information on this subject, and obtained it from Mr. WISEMAN, of Paglesham, who was a great authority on oyster breeding, and might have contributed some valuable information to this discussion had he been present. The species of oyster cultivated by Mr. WISEMAN was known as the "Green Fin," and was held in great repute. He gave the following particulars respecting the annual rent of oyster layings contiguous to each other in Essex, and containing about 800 acres :—

| | | |
|---|---|---|
| In 1770 to 1793 | . . | £140 per annum. |
| „ 1793 „ 1810 | . . | 170 „ „ |
| „ 1810 „ 1831 | . . | 1,050 „ „ |
| „ 1831 „ 1845 | . . | 750 „ „ |
| „ 1845 „ 1859 | . . | 900 „ „ |
| „ 1859 „ 1879 | . . | 1,000 „ „ |

The lease was on the eve of being renewed at a considerable increase of rent.

He was assured there was not the smallest chance of a fall in the price of oysters, and that the increased rent would be fully justified.

Apropos to the tendency of spat to attach itself to any chance substance which came in its way, he remembered hearing a story of a gentleman in the West Indies who said to the waiter at an hotel, "Go and pick me some oysters off the tree." The explanation of this curious request was, that the boughs of a tree overhanging the sea dipped into the water at high tide, and the spat attached itself to them, and oysters thus literally grew on the tree and were picked off.

Mr. R. B. GRANTHAM (Associate of Council) had seen a good deal of the culture of oysters in the county of Galway.

They were dredged from the shores of the County of Mayo, on the open seaboard of the Atlantic, and were brought in small boats to the east end of the Bay of Galway. Owing to the peculiar character of the limestone formation of the district, the coast was strewn with detached rocks, the spaces between which were filled with the detritus of the rocks, forming a smooth chalky bottom to the creeks and crannies, into which the oysters were thrown from the boats and left to mature and develope. They were of a very poor and small kind when first planted in these beds, which resembled gardens as seen from the tops of the cliffs above them. The oysters were so arranged in the beds as to leave passages for the collecting carts, in which they were carried long distances—to Dublin and elsewhere—for sale. They became, by feeding, remarkably fine, and consisted of the black and green fin, supposed to distinguish the male and female. The author of the Paper had alluded to the appearance of the spat when it was first ready to be emitted. It had been correctly described as a milky looking secretion, and when examined under the microscope it was found to be all in motion, and the little oysters could be seen floating about in it.

From his own observation of spat he believed that temperature—not the temperature of the water only, which, at certain depths, is more uniform, but of the substances to which it attached itself—had a great deal to do with its preservation and development. For this reason, he thought, it was that tiles, hurdles, and timber had been used with so much success, as they were not readily affected by alternations of temperature. The apparent preference of the spat for the undersides of substances was probably explainable in this way—that the portion of the spat which endeavoured to attach itself to the upper surfaces and sides of the collectors

was washed away by the stream, while the portion attached to the under surfaces was protected from disturbance.

It would be interesting to know something about the characteristics of the soils, aspect, shelter, and the nature of the tides, where most successful results had been obtained, as he believed that this exercised an important influence. Information of the kind might serve as a very useful guide in selecting suitable localities for the establishment of oyster beds.

Mr. Howard Martin thanked the President and Members present for the kind reception given to his Paper.

As regards the different kinds of collectors, Mr. Driver was quite right in speaking of hurdles as good for the collection of the spat, and they had one especial advantage—viz., that, as he had pointed out in his Paper, the bark could be easily peeled off with the spat upon it, and in that way the spat could be removed without injury; but they had one great disadvantage—viz., their concave surfaces caused a bad shape in the spat attached to them, and good shape is considered by experts as important in an oyster as it is in a horse. Tiles, on the other hand, were as good collectors as hurdles; being flat, they allowed of a proper development of the young oysters, and, if coated with a sort of artificial bark of clay and cement, the spat could be removed from them in the same way as from a hurdle.

Attention had been called by Mr. Watney to the small expenses incurred in constructing and stocking the Brading ponds. There was no doubt that it was small relatively to the return, but, however disproportionate the cost might seem to be, he could vouch for the accuracy of his figures. About £80 was spent for the 60,000 parent oysters. They were brought from Armericaine and Arcachon, and averaged

about 25*s.* per thousand. The faggots, tiles, pen-stocks, and so forth, cost about another £80, and the earth work about £250. They had men at day work, and an active intelligent foreman who lived on the spot, and gave his whole time to the superintendence of the operations.

The experience of Mr. Fell Woods in the breeding of oysters was so exceptional that he should not venture to contradict any opinion which he had deliberately formed on any point connected with it; but he would like to say why he thought that spat had a choice in the place of attachment, and he thought that a fact which Mr. Fell Woods had mentioned rather tended to corroborate his views. That gentleman observed that in some years dark surfaces were occupied by the spat, and in other years light surfaces; but he gathered from what Mr. Fell Woods said that the spat was generally unequally distributed. Might it not be that the spat had a choice, but that the choice was capricious, or was determined by influences of which nothing was known? He had explained that, in laying out the ponds, the parent oysters were laid in a gangway across the centre of the ponds, and the wires placed in parallel rows on both sides of this gangway, so as to keep the collectors about 18 inches from the bottom, and about 2 feet below the surface of the water. It was clear, therefore, that the spat did not attach itself to the under surface of the collectors merely, as Mr. Fell Woods suggested, because they were above it as it rose, but that it had to sink again after rising, to get at those under surfaces. Moreover, as the tiles were only placed at the ends of the ponds farthest from the gangway in the centres, in which the parent oysters were laid, it seemed probable that, whether or not the spat exercised any choice in this attachment, at any rate they deliberately swam into their positions under these tiles, instead of being carried there involuntarily by the water.

A question had been asked by Mr. Fell Woods as to the use of strainers. Canvas was used at the outlets in the pond in which a heavy fall of spat had taken place in 1876. Last year sluices were employed to regulate the water flow, but no attempt was made to keep in the spat by strainers, which had only been used to exclude crabs, &c.

As to the question of temperature, he was not prepared to say that temperature made *no* difference. On the contrary, he thought it made a very great difference. Most summers were warm enough for the purpose, at some time or other; the mischief lay in the fact that, owing to the variable climate of this country, the temperature might not be sufficiently high at a particular time, and it was this circumstance that affected the spat. It seemed to him that Mr. Wiseman's evidence proved that most of our summers were warm enough, taking the whole season into consideration. Voluminous tables of temperature were prepared for the Irish Commission by Professor Hennessey, and that Commission thought that nearly every summer was warm enough on the south-west coast of England and round the coast of Ireland for the production and development of oyster spat; what was to be especially feared was a sudden fall of temperature just at the critical time when the spat was floating.

The question of soil, alluded to by Mr. Grantham, was too large a matter to enter upon that evening. There was an old saying, that it was no use establishing oyster beds in any place where oysters had not been before—*i.e.*, that all places suitable for the breeding of oysters had previously been naturally occupied by them. He again thanked the Members for the kindness with which they had listened to him.

The President said that he was sure he was expressing the sense of the Meeting in returning their thanks to Mr.

Howard Martin for his very excellent Paper, and also for his observations with which he had supplemented his Paper.

The vote of thanks having been put and carried unanimously, the Meeting adjourned.

# PRELIMINARY REPORT

OF

# THE COMMITTEE OF THE COUNCIL

*Appointed February 11th, 1878, to examine the provisions of*

# THE METROPOLIS MANAGEMENT AND BUILDING ACTS AMENDMENT BILL, 1878.

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Your Committee, appointed by a resolution of the Council, passed at their Meeting on February 11th, 1878, have held several Meetings to consider the provisions of the above Bill.

Under ordinary circumstances your Committee would have sought the assistance of Mr. PHILBRICK (the legal Associate of Council), but were prevented in this case from doing so, from his position as standing Counsel of the Metropolitan Board of Works. Their deliberations, however, have been greatly aided by a written opinion, prepared at their request, upon various points of difficult interpretation, by Mr. F. MEADOWS WHITE (Associate), to whom your Committee desire to acknowledge the obligations of the Institution for his kind services.

Your Committee, having been given to understand that the Metropolitan Board of Works have made several important modifications in certain clauses of the Bill which appeared to be objectionable, desire, for the present, to suspend their further Report.

(Signed) EDMUND JAMES SMITH,
*March 11th*, 1878. *Chairman.*

# METROPOLIS MANAGEMENT AND BUILDING ACTS AMENDMENT BILL, 1878.

## PRÉCIS OF THE BILL

*As Amended in the Select Committee of the House of Commons, and observations thereon, forming the further Report of the Committee of the Council.*

The Preamble recites that—

The provisions of existing Acts are insufficient—

(1) As regards the erection and extension of houses and buildings in proximity to or abutting on roads or ways.

(2) As regards the protection of the public frequenting theatres and music-halls from danger from fire.

(3) As regards the making, filling up, and preparation of the foundations and sites of buildings, the quality of the substances and materials used for these purposes, and for walls.

(4) As regards the payment of expenses incurred by the Metropolitan Board of Works in relation to dangerous structures.

The Act applies to the Metropolis as defined by the Metropolis Management Act, 1855.

### Part I.

The term "roadway" is defined as the whole space open for traffic, including footways (if any). The term "the

centre of the roadway" is defined as the centre of the roadway . . . . as existing immediately before the time when first after the passing of the Act or the formation of the same any house or building fronting towards or abutting upon such roadway was begun to be constructed or extended.

*The effect of this definition would seem to be to preserve all existing rights in connection with established roadways, but to prevent persons from erecting the first few houses upon new roads (where, from the nature of the case, no street-line had been defined, under the Act of* 1862) *in such positions as to interfere with the future establishment of a proper street-line. This amended Interpretation Clause, when read in conjunction with the amended proviso at the end of Clause* 6, *removes much of the objection raised by the Committee of the Council of the Institution with regard to the proviso which it supersedes, on the ground of uncertainty as to its bearing upon properties situated upon old thoroughfares.*

The term "the prescribed distance" is defined as meaning a distance of 20 ft. from the centre of a roadway when used for carriage traffic, and 10 ft. when used for foot traffic only.

5. By Clause 5 the special powers vested in the Commissioners of Sewers of the City of London are preserved.

6. The operative part of Clause 6 enacts that after the passing of the Acts no building may be begun to be constructed, or extended in such a position that the external wall, whether of the building or of the forecourt (if any), shall be less than the prescribed distance from the centre of the roadway, except by special permission of the Board. The owner, occupier, or builder may be called upon to set back the building to the prescribed distance, or to that sanctioned by the Board.

*The original proviso (lines* 17—20), *which excepted houses to which the provisions of Sec.* 75 *of the Act of* 1862 *were*

*applicable, was considered to be dangerously vague, and has been greatly modified; the proviso as amended declaring that—*

The operative part of Clause 6 is not to apply to the construction or extension of buildings within any area lawfully occupied by buildings within a preceding period of two years, or to any buildings in course of erection at the time of the passing of the Act, or where the area had been laid out for building purposes before the passing of the Act.

*This amendment will meet the objection which might be held to apply to the original Bill that, under its provisions, an owner who pulled down a building in an existing street, and allowed some time to elapse before re-constructing it, might, in the interval, by the demolition of adjoining houses, have lost his rights with reference to the previous street-line, and might have been compelled to rebuild his house at the prescribed distance from the centre of the roadway. The amendment of the Clause will also save all existing rights connected with agreements for covering building land.*

Clause 7.

This Clause deals with the regulation of ways which are not highways. It empowers the Board, in cases where they have received notice of the intention to form a way into a highway, to serve a notice (within two months of the time when notice was first given them of the erection or extension of a building at less than the prescribed distance from such way), calling upon the builder to set back his building to the prescribed distance, or to some other distance as the Board may determine; and, in the event of non-compliance, to refuse to allow such way to become a highway.

*The limitation as to the time within which the notice must be served was, presumably, introduced in Committee to obviate, as much as possible, interference with structures in a state approaching completion, and to induce prompt action with reference to such structures.*

Full dispensing powers are reserved to the Board under Clause 7, and, as in Clause 6, special exception is made in favour of an area lawfully occupied by any building within two years of the passing of the Act, or in favour of any building in course of construction at the time of the passing of the Act.

e 8. In case the owner, occupier, or builder fails to comply within twenty-eight days, or within a reasonable time after such period, with the notice of the Board to set back a building, a justice of the peace may, upon complaint, issue a summons and fix a place of hearing. Upon proof being given, the justice may issue an order for compliance within a reasonable time—the offending person to pay the costs. The penalty to range from forty shillings to five pounds, with a further penalty of from ten to forty shillings per day until the requirements of the Board are satisfied.

When the way is intended for a highway, but not opened as such, the preceding provisions not to apply.

e 9. Clause 9 enacts that no highway formed or laid out for foot traffic only, *after the passing of the Act*, shall except by consent of the Board be used for carriage traffic, unless the space for traffic be 40 ft. in width where there are buildings on both sides, or, where there are buildings on one side only, unless there be a distance of 20 ft. between the centre of the space open for traffic and such buildings, under a maximum penalty of £50.

e 10. Clause 10 enacts that no highway formed or laid out for foot traffic only, *before the passing of the Act*, shall be used for carriage traffic for more than 7 consecutive days without the consent of a Justice, unless of the width defined in the foregoing clause. Twenty-eight days' notice must be served upon the Board of the intention to apply for a Justice's consent, and the Board may be heard thereon. The maximum penalty for breach of the provision to be £20.

*The effect of Clause* 9 *is to place highways formed for foot traffic, after the passing of the Act, under the regulation of the Board, and the effect of Clause* 10 *to continue the control of existing highways used for foot traffic, in the hands of the Justices, but giving the Board a* locus standi *at the hearing of application for consent.*

Clause 11. This Clause deals wholly with the construction of houses and places of public resort, with a view to protection from danger from fire. The provisions of the clause are applicable to such places only as have a superficial area of upwards of 500 square feet. The Board may serve a notice upon the owner, requiring him to remove any defects which can be remedied at a moderate cost, under penalties, unless the owner within fourteen days gives notice of appeal. An arbitrator shall, in such cases, be appointed by a Secretary of State, and the arbitrator may deal as he sees fit with the order of the Board and the apportionment of the costs. His decision to be final.

Clause 12. This Clause empowers the Board to make, alter, vary, and amend regulations with respect to buildings affected by Clause 11; and also enacts that no buildings and places shall be used for purposes of public resort unless duly certificated by the Board.

## Part II.

In this part of the Act the Board take power to regulate the making, filling up, and preparation of foundations and sites of buildings, the quality of the substances and materials used for these purposes, and for walls.

Clause 13. Clause 13 defines the meanings to be attached to the terms "foundations and sites."

Clauses 14 & 15. Clauses 14 and 15 invest the Board with powers of a rather wide character with reference to the framing of bye-

laws with respect to foundations and sites of buildings, and the materials used in forming the same, and for defining the duties and regulating the fees of district Surveyors.

Clause 15 also empowers the Board to enact bye-laws (to be confirmed by a Principal Secretary of State) compelling the deposit of plans and sections of public buildings and certain other buildings, and for the inspection of houses and buildings, and of the plans and sections of such buildings, and for the alteration or removal of buildings erected in contravention of the bye-laws of the Board, and for the imposition of reasonable penalties for neglect after notice given.

*Considerable modifications have been made in the latter provisions of this Clause in the passage of the Bill through Committee. The corresponding Clause of the original Bill required the deposit of plans and sections of all houses and buildings about to be constructed—a requirement which it was thought was likely to operate injuriously. The Clause received special attention at the hands of the Committee of Council. The Bill as amended requires a deposit of plans and sections in the case of public buildings only, and as regards other buildings a mere inspection of the plans and sections if desired.*

This Clause of the Bill further stipulates that no bye-law for the above purposes, or any changes in the same, shall be confirmed by a Principal Secretary of State, unless two months' previous notice of application for such confirmation shall have been given to the Royal Institute of British Architects and to the Institution of Surveyors, to whom copies of such proposed bye-laws and notices are to be forwarded. Notice of objection may then be given to the confirming authority, who shall consider the same. The Clause also invests the Board with dispensing powers as regards the operation of bye-laws, and the penalties attaching to the breach of them.

*The powers sought by the Board in the original Bill, with*

*reference to bye-laws, were thought to be of too irresponsible a character. The introduction of the confirming authority and the stipulation, as to notice, to the Professional Societies, will tend to give a definite, permanent, and practical character to those provisions of the Bill, and to place them in accord with the feelings of the Profession. The powers conferred upon the Board by Sections* 202 *and* 203 *of the Act of* 1855 *with reference to the making of bye-laws are preserved, but the confirming power which, under those sections, lay with the Board itself, is not re-imposed on the Board by this Clause.*

Clause 16. This Clause empowers the district Surveyor to serve a notice upon the occupier, owner, or builder of any building which fails to comply, as regards the preparation of the foundations or sites, the construction, or quality of materials, with the requirements of the Bill, to pull down and remove such building, wholly or in part, as may be necessary. In case of non-compliance within twenty-eight days, cumulative penalties are incurred. Notwithstanding the payment of the penalty, the Board may, if the non-compliance be persisted in, lay complaint before a justice of the peace, who may grant a summons and, after hearing the case, may issue an order empowering the Board to enter and pull down the house, and to sell the materials, unless the expenses are paid within fourteen days. The Board, however, have the option of seeking to recover the whole expenses by process of law, or by the sale of materials, or, where the amount so realized is insufficient, the balance by process of law.

*The summary powers proposed to be conferred upon the Board by the original Bill, to enter and pull down buildings, have in this, as in the* 10*th clause of the amended Bill, been considerably curtailed by the reference to a justice of the peace, as an intermediate authority.*

Clause 17. This Clause provides for an appeal to the "Appeal

Committee of the Board" (within seven days after the service of notice under the provisions of the foregoing sections of this part of the Act), who shall order an inspection, and confirm, modify, or rescind the previous notice.

ause 18. This Clause applies to dangerous structures as defined by the Act of 1855, and provides that any person to whom the Board, under section 74 of that Act, may have sold the structure, may enter upon the land, and pull down the same and remove the materials.

The Clause further stipulates that when the proceeds of the sale of a dangerous structure, as defined under section 74 of the Act of 1855, are insufficient to recoup the expenses of the Board in respect of it, no part of the land occupied by the structure can be built upon until the balance of expenses has been paid.

*The last paragraph embodies a very important variation from the provisions of the original Bill. The powers sought therein by the Board to sell the fee simple of the land were of a highly objectionable character. The penal effects of the Clause, as amended, are probably sufficiently severe to secure the object sought, without endangering the collateral or contingent interests of unoffending persons.*

The last paragraph of Clause 18 gives a title, under the seal of the Board, to purchasers of land sold under the provisions of the dangerous structures Clauses of the original Bill.

*This paragraph appears to have been left in the amended Bill by an oversight, as the object of it would seem to be to enable the Board to give a marketable title to land sold under penal provisions of Clause* 18 *of the original Bill, which have been modified as above.*

ause 19. This Clause specially exempts the City of London from the operation of Part II. of the Bill.

## Part III.

Clause 20. This Clause empowers the architect of the Board, or other authorized person, to enter and inspect any house, room, or place of public resort at any reasonable time during erection or after completion, and gives similar powers to district Surveyors in respect of any houses or buildings affected by the provisions of the Bill.

Clause 21. This Clause empowers any owner, builder, or the servants and representatives of either, after seven days' notice to the occupier, to enter any building for the execution of any works necessary to satisfy the requirements of the Board. The penalty for resisting such entry not to exceed £20.

Clause 22. Penalties imposed by Part I. of the Bill, and any penalty imposed by or incurred in respect of a breach of any bye-law under Part II. of the Bill to be recoverable by summary proceedings as under the Act of 1855. Accumulated penalties may be included in one summons.

Clause 23. The provisions of the Act to be ancillary to, and not in substitution of, the Metropolis Management and Metropolitan Building Acts and their amending Acts, and all existing exemptions to be preserved.

Clause 24. Exempts the Inner and Middle Temple.

Clause 25. Exempts Crown property and certain rights in respect of such property which are in abeyance, from the operation of the Act, except by consent of the representatives of the Crown.

(Signed) Edmund James Smith,
*Chairman.*

*April 8th,* 1878.

No. 76.]

# THE HYDROGEOLOGY OF MIDDLESEX AND PART OF HERTFORDSHIRE,

## SHOWING THE ORIGINAL POSITION OF THE ARTESIAN PLANE, AND ITS PRESENT POSITION OVER THE METROPOLITAN AREA OF DEPRESSION, AS LOWERED BY PUMPING.

By JOSEPH LUCAS (Associate).

*Read at the Ordinary General Meeting of the* Institution of Surveyors, *April 29th*, 1878.

THE PRESIDENT IN THE CHAIR.

For the sake of convenience I give the following synopsis, showing the plan of the Paper which I propose to read this evening.

I.—THE PHYSICAL GEOLOGY.

(A)—Strata Composing, General Form, and position of, the London Basin.

(B)—Details of Physical Structure.

(*a*)—The Anticlinals.

(*b*)—The Synclinals.

(*c*)—Influence of ditto ditto on Artesian System.

II.—THE HYDROGEOLOGY.

(A)—Details of Strata.

(*a*)—The Chalk.

(*b*)—The Tertiaries.

(*c*)—Comparison of the Springs.

(B)—The Axes.
  (*a*)—Geological.
  (*b*)—Hydrographical.
  (*c*)—Hydrogeological.
(C)—The Artesian Plane.
  (*a*)—Original.
  (*b*)—Modern.
(D)—Areas of Overflow.
  (*a*)—Original.
  (*b*)—Modern.
(E)—Yield.

The natural configuration of the artesian water systems of the London basin is dependent upon the elevation of the area of outcrop of the thick stratum of chalk that subtends the basin into two conspicuous ranges of circumjacent hills, and upon the range in altitude of the outcrop of the water-bearing sands of the tertiary strata upon their flanks. This basin contains a series of minor folds and dome-shaped elevations. The anticlinal folds or arches in the strata consist of:—

1st. That passing through Esher, Merton, Tooting, and Peckham, which is partially dome shaped and attains its greatest elevation at Tooting Graveney.

2nd. The remarkable fold which commences west of Richmond, and passes through Richmond, Mortlake, Fulham, Battersea, South Lambeth, and Kennington, and which also appears to pass through Camberwell and join the Tooting anticlinal at Peckham. After their junction these two anticlinals continue eastwards as a broken anticlinal along the well-known Deptford fault.

3rd. A somewhat flattened dome that underlies a part of London included between Islington, St. Pancras, and the Regent's Park on the north, and Oxford Street, Gray's Inn Road at Holborn, and Hoxton on the south. The axis of this elevation, which is included between two converging synclinals, runs rather north of the Langham Hotel and the Foundling Hospital, across Gray's Inn Road, to Islington

Green. It becomes much contracted westwards, and runs as a narrow ridge through Hammersmith to Turnham Green, where it ends at the junction of the above-named synclinals. This anticlinal was noticed as existing at Gray's Inn Lane by Professor Prestwich, who also perceived that it did not extend far westward.*

4th. The dome-shaped elevation of the strata that culminates under Greenford Green.

5th. The sharp anticlinal crossing the Edgeware Road at the Hyde which, without running as an anticlinal all the way, appears to be upon the same line as the Greenford dome.

6th. The Windsor anticlinal.

Of the downward, or synclinal, rolls, the most important are:—

1st. That passing in a north-easterly direction through Morden, Mitcham, and the Sydenham hills, to Lewisham and Woolwich.

2nd. Eastward of the exceedingly deep depression that carries the top of the chalk nearly 600 feet below sea level at Littleton, near Laleham, are the following ramifications:—

(A) That passing through Kingston and Wimbledon, north of Garratt, to Wandsworth Common, whose range in an easterly direction is determined by the convergence of the Richmond and Tooting anticlinals.

(B) That passing through Isleworth, Kew, Chiswick, Hammersmith, Brompton, under Buckingham Palace, to Charing Cross, whence it follows the course of the River Thames to London Bridge.

(C) From Acton another branch runs in a north-easterly

* "Water-bearing Strata of London," p. 42.

direction through Kilburn, Kentish Town, and Upper Holloway.

These convolutions exercise an important influence on the œconomy of the artesian system. A succession of folds imparts a stability to the system, which it would not possess if the strata descended by a uniform curve. Several causes conspire to favour the lodgment of the water *in transitû* in the upper parts of the chalk, along the lines of the deep-seated anticlinals, and, in its lower parts, along the deep-seated synclinals.

Thus, the effect of the deep-seated synclinals is to let down, far below the artesian water-line, moles, as it were, of impervious tertiary strata, which, by acting as sluices upon the descending springs, induce an accumulation of water or head in the anticlinal above.

The tendency of the deep-seated synclinals is to close up or hinder the formation of normal fissures in the upper parts of the chalk, under the great lateral compression acting upon them; and, for the converse reason, to facilitate their formation in its lower parts. Again, for opposite reasons, the tendency, in the deep-seated anticlinals, is to form fissures in the upper parts of the chalk, and to consolidate its lower portions.

Lastly, the pressure which has forced the water to the deep-seated parts of the chalk under the tertiaries gives it a tendency to reascend to the highest accessible points, which are such of the above-named domes and arches in the strata as do not project above the limits of the system.

Since writing the above, I have been told that Mr. R. W. Mylne, C.E., F.R.S., many years ago, expressed his opinion that there was more water in circulation along the anticlinal than along the synclinal lines. It would be of value to learn the evidence upon which this opinion was founded.

As the present memoir treats principally of the artesian system, it is advisable briefly to summarize the history of the water which passes through the chalk under its area of outcrop, in order that these two important members of the chalk water system may appear properly correlated.

1. Part of the rain which falls upon the area of outcrop of the chalk sinks into it and accumulates in its fissures in a system, presenting a superficies inclined towards the hydrogeological axis of the basin, whose form and dimensions are susceptible of being rendered by contours.

2. This system, though continuously gravitating *en masse* from higher to lower levels in these fissures, yet, being periodically replenished from above, maintains, subject only to consequent vicissitudes of level, the same general form and position.

3. Part of the water that enters into and aids in constituting this system is capitalized and permanently employed in supplying the deep-seated parts of the chalk beneath the tertiaries, while the unexhausted head remaining in the chalk hills expends itself in supplying numerous well-known permanent and intermittent springs.

4. Owing to the porous nature of the chalk itself and the operation of capillarity, part of the water which sinks into the system is sucked into the solid mass of the chalk, which—

(A) Below the minimum water line, must be saturated to the extent of its maximum porous capacity.

(B) In the sectional area of variation, becomes fully charged by the rising water, and allows the difference between the quantity required to effect this total saturation and that which can be retained by capillarity to drain out with the falling water. The operation of this secondary feed con-

tinued over many months retards the descent of the "water-line" of the free water in the fissures, and tends to equalize the flow of the effluent springs, and

(c) Above the maximum water line cannot, as it appears to me, be saturated to a greater extent than the retentive power of capillarity.

*These are cardinal points in Hydrogeology.*

Stability is therefore a characteristic of the artesian curve of pressures that appertains to the chalk, since the water which descends with the dip of the strata into the artesian system does so under a pressure, whose variations are so slight as to be comparatively insensible, the greater portion of any increase apparently due to each increment in the quantity of water in store in the chalk hills being expended in augumenting the discharge through the above-named surface springs.

Upon the chalk there lie some water-bearing sands, known as the "grey sands," or "Thanet sands," which extend only over the south-eastern portion of the tertiary area; and in the Reading beds above these there is a bed of sand which extends, with or without pebbles, over the whole area under review, being strongly developed on the northern side. Where both are present, water is usually found in the grey sand; but, where this is absent, it is replaced as a water-bearing bed by the upper sand or its local representative.

Along the line of its outcrop, from Harefield to Hatfield, this bed of sand is some 12 feet thick, and is separated from the chalk by some argillaceous beds.

The grey sand contains a highly argillaceous admixture in its lowest part, which serves to isolate it as a water system from that of the chalk. For the purposes of the present memoir, the tertiary strata are taken to consist of water-

bearing sands lying upon the chalk, and of impervious clays lying upon the sands.

There is, it is true, at the base of the London clay, a sandy bed which is scantily water-bearing, and which was of importance to the well diggers of the last century. There are many old wells still in use which were originally dug to this bed, and have since been supplemented with borings to the grey sands or the chalk, and others which, notwithstanding such auxiliary borings, remain wholly dependent upon this source. There are, then, three principal sources from which water ascends in the artesian wells and borings of the London basin—the chalk and the overlying sands.

These are independent systems, subject to independent sources of pressure, and though the levels assumed by their several waters may sometimes coincide, they are rarely found to do so. One of the principal difficulties that face the hydrogeologist is the uncertainty as to the source of the springs in any particular well.

It is therefore necessary to distinguish carefully the levels assumed by—

1. The chalk springs,
2. The sand springs, and
3. The chalk and sand springs together, not only on theoretical but on practical grounds. Thus, when the chalk springs rise to a higher level than the sand springs, the sand will be fed by the chalk; but, where the sand springs rise to a higher level than the chalk springs, the superinduced head on the chalk springs will reverse the flow, and there will be a feed into the chalk. The level assumed by the water in both cases will be at some intermediate point between the levels of the sand and chalk springs, when separate.

The grey sands outcrop along the southern confines of

the tertiary area, and range in altitude from the levels of the several chalk springs to the alternating spurs of tertiary strata that ascend the lower slopes of the chalk hills. In such positions they hold up water at a considerable elevation above the water in the chalk beneath, and are freely utilized as a source of supply to shallow wells.

The water stored in these high ranges serves to give a head which operates upon the adjacent parts of the artesian area more powerfully than that of the more distant chalk water of equal elevation, and, in consequence, over the districts under the influence of these local elevations, the water from the sands rises to a higher level than that from the chalk.

On the south side of the basin, within the limits of the Paper, the sand springs predominate over the tertiary area (which lies high on the Farnborough and Addington ranges) in North Kent, having an advantage of some 7 or 8 feet over the chalk springs in the Ravensbourne Valley, which diminishes on approaching the Wandle Basin, where, in consequence of the lowering of the outcrop of the grey sands to the level of the Wandle sources, the chalk springs locally prevail. This brief ascendancy is soon lost, however, and west of the Wandle the sand springs rise several feet above those of the chalk. At Kingston the difference is some 7 feet. The general ascendancy of the Reading sand springs appears to extend over the valley of the Thames at least as far west as Staines, and over the whole of the tertiary area in Middlesex.

The River Colne, above Denham, lies in the plane of the minimum water-line in the chalk water system, under its area of outcrop. This plane produced, passes under the tertiary escarpment and under the outcrop of the water-bearing sands along its base, falling from the Colne

towards the hydrogeological axis. There are, however, several points along the line at which there is a powerful feed from the tertiary strata; and this has the effect of locally reversing the flow, which sheds on all sides from these points of irruption. The chalk water falls towards the Colne under the influence of this feed, or towards the north-west, between Potter's Bar and Marsh Moor, near Hatfield Park, between South Mims and London Colney, Radlett and Colney Street, Bushey and Watford, and the northern end of Ruislip Wood and Rickmansworth.

The figure of the artesian plane and the position of the hydrogeological axes are partly determined by the relative positions of the physical or geological and the hydrographical axes of the system.

It is obvious that, if the hydrographical axis, or the main river channel, coincided with the physical axis, or ran equidistant between the northern and southern outcrop of the chalk, the hydrogeological axis, or the line of least pressure, would lie along the same line. Owing to the great changes that have affected the artesian plane in the last fifty years, it is advisable to deal separately with its original position, and its vastly reduced modern representative, over the Metropolitan area of depression.

To take first the original Artesian Plane:—

The main hydrogeological axis of the system, by geographical position, runs eastward from Hungerford, through Newbury, Sandhurst, Walton-on-Thames, Teddington, and London, to a point on the Thames in Woolwich Reach, at which the hydrographical axis encounters the chalk of the south side of the basin. This main axis or trough is joined by tributary or lateral axes proceeding from the breaches or low points in the chalk hills near Basingstoke, Farnham, Guildford, Leatherhead, Ewell, and Carshalton, on the

south; and on the north by one from the gorge of the Thames, through Cookham and Windsor, and another from the low lip of the chalk in the Colne Valley at Denham.

The deepest of these—and in that sense the main axis of the system—is that passing through Windsor, which coincides *absolutely* with the hydrographical axis in that part of the course of the Thames which lies in the area of outcrop of the chalk west of Cookham, and *generally*—as regards direction, but not elevation—between Windsor and Woolwich Reach. The axis is inclined as far as Woolwich Reach. East of Woolwich Reach the plane of the horizon is a tangent to the curve of pressures that marks in that part of its course, on the north side, the artesian plane, and, on the south side, the actual water-line in the chalk.

Professor Prestwich, with great perspicacity, noticed, as long ago as 1850,* that there was "some impediment to the free subterranean passage of water" across a line drawn from Deptford to Windsor, which, however, he ascribed to a wrong cause. This line is the hydrogeological axis described above, and the reason why there is the "impediment" named is, simply, that the water falls and flows from both sides towards the bottom of the trough.

As the artesian planes, under natural conditions, are superficies inclined from both sides towards the hydrogeological axis, they are susceptible of definition in their several maximum and minimum positions, by means of contours or lines passing through points of equal altitude in each.

Again, as this axis is itself inclined, as far as the outcrop of the chalk in Woolwich Reach, that may be regarded as the focus, at the level of Ordnance Datum, around which

* "Water-bearing Strata of London," p. 48.

the contours, at greater elevations, describe (omitting sinuosities) their parabolic course.

The whole artesian and chalk water system, west of a line drawn through Keston, Bickley, and Eltham, to Woolwich, and thence, in a north-westerly direction, to South Mims, naturally sheds towards this point.

This point is the farthest inland attained, under natural conditions, by the contour at the level of Ordnance Datum, whose course seawards takes a curve, passing through the angles of the river on either side, such as Woolwich, Erith, Greenhithe, Gravesend, &c., on the south side; Horseshoe Corner, Rainham Creek, Purfleet, Gray's Thurrock, &c., on the north side.

The evidence for the superior contours is found in the history of the artesian system, which begins with the year 1822, though, probably, the oldest overflowing well was that at Norland House, Notting Hill, sunk and bored, in 1794, as far as the grey sand.

In 1822, a boring was put down into the grey sand, near Tooting Church, from which a jet of water rose to the level of 70 feet above O.D.; and another at a house called The Cannons, Mitcham, from which a jet rose to about 80 feet above O.D. In 1823, borings into the chalk were made at Ravenscourt Park, Hammersmith, from which the jet is said to have risen to 42 feet above O.D.; at Mr. Bird's, at Brook Green, from which the jet attained 33½ feet above O.D.; and at the Horticultural Society's Gardens, at Chiswick, from which a jet reached 35 feet above O.D. In the latter part of the same and the beginning of the following year, at Fulham Palace, from which a jet reached 22½ feet above O.D. In 1824, borings were put down into the chalk at Springvale Works, Hammersmith, from which a jet rose to 32 feet above O.D.; at Booth's Distillery, Brentford, from

which the jet reached 41 feet above O.D.; and at Wormwood Scrubs, where it reached 35 feet above O.D.

In 1825, borings were made into the chalk at the Swan Brewery, Walham Green, from which the jet reached 24 feet above O.D.; and at Norwood Vitriol Works, Heston, which overflowed at the height of 95 feet above O.D., and for some years afterwards continued to flow into the canal.

From the above series of fixed points there appears a well-marked curve of pressures, or a transverse section of the basin.

Thus we have—

| Date. | | Feet above O.D. |
|---|---|---|
| | Wandle at Wallington . . . . . | 90 chalk |
| 1822 | Cannons, Mitcham . . . . . | 80 sand |
| 1822 | Tooting Church . . . . . | 70 „ |
| 1824 | Fulham Palace . . . . . | 22½ chalk |
| 1825 | Swan Brewery, Walham Green. . . | 24 „ |
| 1823 | Bird's, Brook Green . . . . . | 33½ „ |
| 1824 | Wormwood Scrubs . . . . . | 35 „ |
| 1794 | Norland House . . . . . about | 36 sand |

Fulham Palace lies at the lowest point of the curve—*i.e.*, on the hydrogeological axis, or line of least pressure.

Again we have—

| Date. | | Feet above O.D. |
|---|---|---|
| 1824 | Mr. Engleheart's, East Acton . . . | 36 chalk |
| 1824 | Booth's, Brentford . . . . . | 41 „ |
| 1823 | Horticultural Gardens, Chiswick . . | 35 „ |
| 1823 | Ravenscourt Park . . . . . | 42? „ |
| 1824 | Springvale Works . . . . . | 32 „ |

Now, it is held that, as these are the first wells sunk in the basin, they are evidence as to the original position of the artesian plane over the area in which they lie.

A scarcely perceptible depression appears to have set in in the year 1824, and to have manifested itself in the shortcomings of the wells put down in that year. They began to fall a little short of the height they should have attained on the basis of those previously bored, which must, of course, have been lowered by them.

The above-named series of wells, taken in connection with the focus at Woolwich Reach at O.D., and the fixed point on the Ravensbourne at Deptford, afford evidence for the parabolic course of the artesian contours at 30 and 40 feet above O.D.; and so, by inference, of those at 20 and 10 feet. The 30 feet contour, starting from the Cray, near Crayford, ran north of Eltham, whence, owing to the outcrop of the chalk in the bed of the Ravensbourne at Deptford (ranging from about 15 to 25 feet), it was pulled back to Lewisham. Thence it described a curve, passing through Peckham Rye, Stockwell, and Clapham, to Wandsworth, Putney, and Mortlake, where it crossed the axis and turned in a north-easterly direction through Hammersmith, Kensington Gardens, and Islington.

The details of the evidence for the 40 ft. contour and those at higher levels in the county of Surrey have already been described by me.*

In respect of the extra-metropolitan parts of the county of Middlesex, the evidence for the position of the original artesian plane may be taken as a whole, without following in detail the course of each contour at every successive 10 feet of altitude.

For this purpose the following points have been extracted from the tables appended, and are adopted by me as lying in the original artesian plane :—

* "The Artesian System of the Thames Basin." (Journal of Society of Arts, May 11th, 1877.)

| Date. | Water above O.D. | | Original Level of Water above O.D. |
|---|---|---|---|
| | | | Ft. |
| 1833 | | The Priory, Hornsey . about | 70 (? sand) |
| | | Cricklewood . . . . . | 69..... chalk |
| | | Hendon Union Workhouse . | 120..... ,, |
| | | Jakeman's, late Kilby's, Willesden . . . . . | 97 (sand) |
| | | Coach and Horses, Stonebridge . . . . about | 86 (sand) |
| | | Friar's Place Farm . . . | 54..... ,, |
| 1824 | | Mr. Markwait's, late Engleheart's, East Acton . . . | 86 (? sand) |
| 1856 | 81 | Alperton . . . . . | — |
| 1843 | | Aspen Lodge, Sudbury . . | 113..... ,, |
| 1843 | | Lowlands . . . . . | —..... ,, |
| | | Greenford Green Colour Factory . . . . (ground | 95 overflow'd),, |
| | | Greenford Manor Farm . . | 100..... ,, |
| | | Hare and Hounds. . . . | 108..... ,, |
| | | Norwood Court . . . . | 95..... ,, |
| | | Salmon's, Hounslow . . . | 65..... sand |
| | | Wilmot's, Isleworth . . . | —..... ,, |
| | | St. Margaret's . . . . . | 45 just in chalk |
| 1835 | | Littleton House . . . . | 58..... sand |
| 1850 | | Ashby's Brewery, Staines. . | 63..... chalk |
| | | West Drayton, Victoria Oil Mills . . (rather above) | 112..... ,, |
| | | Uxbridge Union Workhouse about | 116..... ,, |
| 1839 | | Dawley Court . . . . . | 117..... ,, |
| | (near) | Adam and Eve, Hayes . . | 117 |
| 1848 | 104 | Manor Farm, Yeading . . | — |
| 1853 | 108 | Fordham's, late Dan Gurney's, West End, Northolt . . . | —..... ,, |
| | | Uxbridge, Hillingdon End . | 121 |
| | | Ickenham, public well . . | 140 sand or mixed |
| | | Ruislip, do. do. . . | 154 ,, ,, ,, |
| | | The Woodman . . . . | 137 |

The various wells near Batchworth Heath, in Ruislip Parish, given in the Tables appended proving modern levels from 175 ft. to 190 ft., and which are deemed to be unaffected.

The above supply the elements for reconstructing the facies of the orginal artesian plane over a considerable area, when taken with the fixed points. Thus the 100 feet contour, starting at Hertford as a natural contour in the chalk, takes a south-easterly course to the valley of the Lea, east of Hoddesdon, there crossing the surface contour of equal elevation, and thus traversing an area of overflow.

From Hoddesdon it turns towards the south-west through Broxbourne, Cheshunt, by Finchley and Hendon, to Greenford, where it again traverses an area of overflow.

It thence passes through Cranford, and crossing another area of overflow as far as the Colne, takes a north-westerly course to the chalk bed of the Thames above Great Marlow. From Great Marlow it takes a southerly course, and probably curves somewhat to the west, crossing the hydro-geological axis in the Blackwater Valley. Thence it strikes south-east to Guildford; from Guildford it passes, by a northerly curve, to the Mole at Leatherhead, &c.

The 50 feet contour on the original plane traversed the area of overflow in the Lea Valley at Tottenham High Cross, whence it ran in a south-westerly direction through Kilburn, Friar's Place, Acton, Brentford, and Isleworth, by Sunbury and Shepperton, to Chertsey. Thence curving north-west-by-north in the direction of Windsor, it probably runs as far west as Chobham before it crosses the main axis.

It probably crosses the Wey at Byfleet and the Mole at Cobham, and, inasmuch as the surface contour in both these valleys runs south of those points, indicates two areas of overflow, which, as far as I know, are yet unproved. In the Wey Valley this appears to extend from Byfleet Bridge to Pirford Bridge, and in the Mole to occupy the westerly curve of the river at Cobham.

The gradual lowering of the artesian plane from the original position described above is now a matter of familiar history. Without specially following the various dated memoranda made at intervals during the fifty six years that have elapsed since 1822, which are given in the tables appended, allusion may be made to the valuable unpublished register of Monday morning levels taken at the Bank of England since the year 1852. It is also interesting to note that the well at Bell's Brewery, Parson's Green, Fulham,

sunk in 1833, overflowed at that date; and I was informed by an old carpenter, who has been in the service of the Bishops of London at Fulham Palace since 1836, that the well there had ceased to overflow before that year (1836).

Without stopping to consider the form and extent of the depression at any intermediate date, that having been brought up to a comparatively recent period by the Rev. J. C. Clutterbuck, it will suffice to take it as it stood in the year 1877.

The depression may be contoured in respect of maximum and minimum levels, by taking the figure that marks the limit of suction as the minimum (except in a few cases in which the pumps are not low enough), and the Monday morning level when most of the Metropolitan pumps have had about forty hours rest as the maximum. The levels are affected by the season. In the spring of 1877 the water was unusually high, for which reason the contours given for that period may be taken as approximate maxima. Owing to the inequality in working many of the pumps, it would be impossible to give a facies for this depression that could be said absolutely to represent the exact form at any particular hour of the day unless simultaneous observations were taken all over the Metropolis. The contours given at each 10 ft. of depth below O.D. are, however, very close approximations to the true form of the depression at its maximum elevation in the spring of 1877.

Thus we find the water at Reid's Brewery permanently lowered to about 130 ft. below O.D.; in the wells of Messrs. W. Cubitt and Co, Gray's Inn Road, to about 115 ft. At Webb's Mineral Water-works, Islington Green, the water is at about 100 ft. below O.D.; while at Meux's Brewery, at the corner of Tottenham Court Road, it has fallen below 125 ft. These points lie within an elliptical area, of which Reid's and Meux's wells are the foci, enclosed by the contour at 100 ft. below O.D.

The area of this depression below the level of Ordnance Datum, and west of a line drawn from Hornsey to Woolwich Reach, is not less than 70 square miles. This is by no means the extent of the Metropolitan area of depression, but is probably about two-thirds of that part of it in which the artesian water presents the highly abnormal condition of failing to rise to the level of the waters of the ocean, with which it is in free and open communication.

The area of traceable depression is more extensive on the north-east, north, and west sides than it is on the south side of the Metropolis. On the south-east and south it is felt at Eltham, but falls short of Bromley, Beckenham, and Croydon. It is felt at Mitcham, Malden, and Kingston, but falls short of Carshalton, Ewell, and Epsom. On the west it is felt at Esher, Littleton, and Staines, and extends northwards over Hayes, Ickenham, Ruislip, Harrow, and Edgware, but falls short of the above-mentioned ridge extending from Ruislip Wood, through Stanmore and Potter's Bar.

Of the contours on the modern artesian plane above the level of Ordnance Datum, the 50 ft. contour runs through Laleham, and a little south of Betstile, to Enfield Highway; and the 100 ft. contour now runs through Hayes, West End (Northolt), Harrow, and Edgware, by Totteridge and East Barnet, after which it gradually emerges from the influence of the depression and falls into the original line described above.

The 200 ft. contour crosses the Colne at Colney Chapel, and runs south-east by south, turning round by Radlett and Kendal Hall, after that curving round to the north-east through Wrotham Park, then round North Mims as a centre by Hatfield to the River Lea near Wheathampstead. This remarkable sweep from the Colne to the Lea is due to the influx of the drainage of some 23 square miles of

tertiary strata and gravel covered chalk, into the chalk by the Swallow Holes at Water End, North Mims, and by others at Radlett, and at other points.

The areas of overflow are those portions of the terrestrial surface that lie below the superficies of the artesian plane. Their boundaries are determined by the intersection of the artesian and surface contours. The original 100 ft. artesian contour lay to the south of the 100 ft. surface contour from West Drayton to Cranford, thus traversing an area of overflow. At Bull's Bridge it crossed the surface contour, and ran under the ridge at Southall, again cutting the surface contour at Greenford. It then traversed an area of overflow to the foot of Horsendon Hill. The 50 ft. artesian contour ran from Chertsey by Sunbury, cutting the surface contour south of Hanworth. It passed thence under a ridge to Fulwell, where it again traversed an area of overflow to Gunnersbury, after which it ran under ground till it crossed the 50 ft. surface contour in the Lea Valley, at Tottenham High Cross. Instances might be multiplied, but those given are sufficient to show the principles on which the areas of overflow given on the Hydrogeological Survey Map have been determined. The original areas of overflow thus determined north of the Thames and east of the Colne, appear to have extended from the Thames up the Colne Valley above Uxbridge, up the tributary valley that runs from the Colne at West Drayton as far as the foot of Ruislip Reservoir, and up the branch of that valley that runs by Ruislip as far as Pinner, and to have extended over the flattened ridge separating that valley from Yeading Brook from Ickenham to Ryefield Farm. It ran up the branches of the Yeading Brook as far as the lane leading from Northolt to Eastcot, and extended over the low ridge between Yeading and the Brent near Greenford. It extended the whole way down the continuation of Yeading Brook, or the valley of the

Crane, to Twickenham, becoming very much contracted at Fulwell, after which it opened out into the main area of overflow of the Thames Valley. With the exception of a ridge running south-east from East Bedfont, through Hanworth to Hampton, it extended over the whole area lying between the Colne and the Crane south of West Drayton and Cranford.

In the Brent valley it extended to Northolt and Greenford Green, and up the valley across the Harrow Road, to about one mile from Kingsbury.

It also extended over the water-shed ridge between the Crane and the Thames at Hounslow. East of the Brent it extended over Hanwell, Brentford; and the boundary ran from Little Ealing through Gunnersbury Park, Acton Station, and East Acton, to Wormwood Scrubs, whence it turned south-east through Notting Hill to Chelsea, running almost to the river bank at Battersea Bridge. From Chelsea it ran north-east by Victoria Station and St. James's Park to the Thames at Charing Cross Bridge, the area of overflow extending over part of Chelsea, Pimlico, and Westminster.

On the south side of the Thames the original area of overflow extended over the triangle between Walton-on-Thames, Hersham, and Molesey, running as far up the Mole Valley as Heywood, and it extended continuously from the Mole to the Wandle, over the low places in the water-shed ridges at New Malden and Merton, running up the Hog's Mill River to Epsom, and up the Beverley Branches to Malden Green and Sutton. In the Metropolitan district it extended from Wandsworth to Clapham, Stockwell, and Camberwell, through Peckham and New Cross to Deptford, falling short of the Thames at Limehouse Reach, but extending over the whole area north of that line excepting a strip along the Thames from London Bridge to Rotherhithe.

In the Ravensbourne Valley, it ran from Lewisham to Elmer's End, and nearly to Shortlands.

Such is the extent of the original areas of overflow coming within the limits of the Paper.

At a moderate computation, within the tract named, there are no less than one hundred and forty square miles of country that could formerly have been watered by overflowing artesian wells.

By the lowering of the artesian plane these areas have become reduced; but it appears that there are still areas of overflow in the Colne Valley, from West Drayton to Staines, thence to Sunbury, Feltham, East Bedfont; the Crane Valley, from Cranford to near Hanworth Farm; Yeading Brook, above Yeading, and west of Down Barns; the Brent Valley, at Greenford, as far east as Perivale, and as far south as Boston House; the lower part of Hampton Court Park; Thames Ditton, and Kingston; the Hog's Mill River, as far south as Malden; the Beverley, from Coombe Lane to Worcester Park, and over by Merton into the Wandle Valley; the Ravensbourne, from Bell Green to Elmer's End, as regards the sand springs, and, probably, also at the southern end of South End: these modern areas together amounting to 36 square miles. In the Lea Valley, the original area of overflow extended from Hoddesdon to Bow, but the modern area, within the limits of the Paper, is confined to Edmonton.

As regards the question of yield in the Metropolitan area, the natural artesian plane being the plane of no delivery, it follows that no inferior line can ever truly represent the zero, as all inferior planes are in unstable equilibrium, and, on the cessation of pumping, quickly re-ascend till its re-commencement. Nevertheless, the Monday morning line represents, for practical purposes, the maximum position of the fluctuating plane of no delivery. This plane

steadily falls from year to year, the total draught of each year exceeding the replenishment during the wet seasons. To estimate the value of the water-line at its present height, it is therefore necessary that every pump in London should cease working at the same hour on Saturday, and re-commence at the same hour on the following Monday morning. We should then have an absolute datum line to start from.

In each case the following particulars would be noted :—

1. Height of water on cessation of pumping on Saturday (say, 2 p.m.), which in most cases would be at the limit of suction.
2. Height of ditto on Monday morning, 6 a.m.
3. Difference, or amount of rise in feet, which, multiplied by the area of the shaft, gives the number of cubic feet of water that have risen into the shaft during that time. This number $\times 6\frac{1}{4}$ gives the number of gallons, which $\div 40$ gives the gallons per hour during that particular forty hours.
4. Number of hours taken to reduce water from Monday morning line at 6 a.m. to suction; or, in the very few cases where the springs exceed the draught of the pumps, to the point of full draught.
5. Number of feet vertical pumped out, which, $\times$ the area of the shaft, gives the quantity in the shaft at 6 a.m., or at the commencement of pumping.
6. The total number of gallons pumped, from which quantity, if the number of gallons in the shaft at 6 a.m. be subtracted, there remains the yield of the springs during the period taken to reduce the water from the Monday morning line to the limit of suction.

7. The yield of the springs at suction—that is, after the water has been reduced to the suction, the number of gallons per hour which are raised by the pumps—and by these means, and these means alone, could any reliable measure of the quantity of water raised from artesian wells in London now be arrived at.

## SUMMARY.

1. Where the overlying impervious stratum lies below the artesian water-line, rapid downward plunges of the strata, or sudden downthrows by means of faults, by acting as sluices, present barriers to the flow of water, and induce an accumulation of *head* on the upward side of the sluice. An instance of the former is found at Tooting, where the head is preserved, being required to discharge the quantity passing under the deep-seated natural sluice formed by the Kingston and Wimbledon and Wandsworth common synclinal. An instance of the latter is the well-known one at Deptford, of which the Kent Water-works Company wisely, and to the great advantage of the population, availed themselves on the advice of Professor Prestwich.

This retardation induces a tendency to escape laterally in the direction of the outfall, or along the anticlinal on the upward side of the synclinal or fault constituting the sluice.

2. As regards the underlying impervious stratum, an uprise of the strata bars the flow in the lowest part of the water-bearing bed, and induces an accumulation of water in the bottom of the accompanying synclinal.

For these reasons, wells sunk on synclinals in the artesian system frequently traverse enormous thicknesses of chalk,

and at last strike a spring near the bottom of that stratum, or stop short of the point at which water might be expected to be found.

I therefore conclude that along the synclinal lines deep borings are advisable, and that along the anticlinal lines experience shows they have not proved necessary, and that if they fail in obtaining water after traversing one or two hundred feet of chalk they should be discontinued.

The knowledge of the position of these lines is therefore of paramount importance for those interested in sinking artesian wells.

3. In the counties of Middlesex and Hertfordshire, between the Colne and the Thames, the flood waters of large tracts of pasture land and of highly-cultivated agricultural land, as well as the total drainage in certain cases, pass into the chalk at certain well-known points of influx, which irruption of waters has the effect of raising the artesian water-line to heights it could not attain from pressure exercised beyond the Colne.

4. There can be no doubt that this natural system is capable of further development, and, when we have a complete survey of the water-bearing strata with all the necessary evidence, we may hope to see their water systems replenished and handled on more scientific principles than the primitive methods now in use.

Mr. S. C. Homersham (Visitor) said that there was one matter specially within his own knowledge to which he should like to refer, It was stated in the Paper that the wells sunk by the Kent Water-works Company were sunk under the advice of Professor Prestwich. This was a mistake, and ought not to go on the notes uncorrected. Up to 1854 or 1855 the Kent Water Company supplied the whole of their extensive district, comprising Deptford,

Greenwich, Woolwich, Plumstead, Charlton, and other places, with water from the River Ravensbourne. That water was very much polluted, and the inhabitants of Plumstead, Woolwich, and Charlton determining to get a supply for themselves from the chalk, established a competing Company, to which he (Mr. HOMERSHAM) was appointed engineer, and accordingly constructed works for that purpose in the years 1852 and 1853. The works were opened early in 1854, and, shortly afterwards, when the new Company had taken from the Kent Water Company something like 1,000 consumers, the latter Company, on their own ground at Deptford, where their works were, sunk a well deep into the chalk, not for the purpose of supplying their own consumers with chalk water, but for the avowed purpose of draining the wells situated at the new works at Plumstead, some four and a half miles distant. This, the Kent Company thought, would be the most effectual way of getting rid of the competition by the Plumstead Company. The Kent Water Company accordingly pumped something like 1½ million gallons a day from the new deep well on their own ground; but this did not in the least affect the supply to the wells of the Plumstead Company. Not disheartened by this, the Kent Water Company determined to sink another deep well. This was found to yield another 1½ million or 2 million gallons per day, still without any effect upon the yield of the Plumstead Company's well. Being at length convinced that they could not affect the Plumstead Company in this way, they thought the best plan would be to buy up the new works and sink other wells in the chalk for the supply of their own district; and since 1862 the water supplied by the Kent Company has been wholly derived from the chalk strata. They had pumped from those wells, up to this time—a period of 16 years,—and the water stood as high in level as it ever did. The Kent

Company had since sunk other wells in the chalk for the supply of other districts, going as far as St. Mary's Cray, and supplying Dartford, and the whole of their district was now supplied with water from the chalk, the yield being more than ten or twelve million gallons a day. During the last 30 years there had been no competition in the supply of water to any portion of the London district, excepting that of the Plumstead Company; and in the Kent Company's district the beneficial effects of this competition were to be seen, as the water now supplied there was uncontaminated and cheaper than that supplied by any other Metropolitan Company.

The alleged depression of the water-level under London must depend for confirmation on some better information than that supplied by the Paper. For instance, everybody knew the well near Trafalgar Square, from which the water was pumped for the fountains, and for the supply of the Government offices, Buckingham Palace, &c. This had been sunk since 1849, some twenty-nine years ago. He had had occasion to examine that well most minutely three years ago, for the purpose of giving evidence on it. The normal level of the water, which varied in different years and in different seasons of the year, after some thirty years' pumping, and although the demands upon it were constantly increasing, was, on an average, much about the same as when it was first sunk. When large quantities of water were being pumped, the level was temporarily lowered, but, when the pumping ceased, the water rapidly rose to the normal level. He did not mean to say that there were not other wells under the London clay, sunk into the chalk, where a depression in the water-level had taken place; but the fact of the falling of those wells did not, he considered, prove that there was a general deficiency of water in the chalk, especially where the chalk was not covered by the clay. Take the

case of towns like Margate, Ramsgate, and Broadstairs, situated in the extreme south-east corner of England. The wells which supplied Margate were sunk by the water company less than a mile from the sea. When pumping was going on, the water was depressed, the level then being some forty or fifty feet below the level of the sea, yet fresh water and not salt water was plentifully obtained. At Ramsgate fresh water was readily obtained, and at Dover also an enormous quantity of fresh water was derived from a well in the chalk near the sea. The Dover works had been in operation for forty or forty-five years; those at Ramsgate for a long period; and those at Margate for fifteen or twenty years (so that they were not new works); and in all these places an ample supply of water was obtained from the chalk. He did not know any instance in his experience of thirty years where wells which had been sunk in the chalk and used to supply a large town of considerable population had afterwards to be given up from loss of water, but he knew of numerous instances where the population had increased from 30,000 to 60,000 or 70,000, without any deficiency in the supply from the chalk. He thought therefore, that the idea of the water-level being artificially and permanently lowered through the chalk districts would not bear investigation. It was a fact that solid chalk was a very bad conductor of water. He did not think too much importance should be attached to the anticlinal and synclinal lines, for it was through faults that water was conducted down into the lower portions of the chalk and that the water-line was found to be disturbed. In the Chiltern Hills, where the water-line in the chalk hills stood 450 to 500 feet above the level of the sea, directly pumping ceased the water rose to its normal level. If solid chalk were a good conductor of water it would not be able to hold the water up to 500 feet above

the sea,—it would find its own level; and the reason why water was plentiful deep down in the chalk strata was that there were, at places, complete breaks or faults in the chalk, and the water found its way down through those faults. The destination of water—whether surface or underground water—flowing out of the chalk was the sea. If water fell on a non-absorbent stratum it would be discharged by gravity at the level of the sea, and if it fell on a stratum that absorbed it the effort of the water was to sink down and escape into the sea. The estuary at Southampton was to a great extent kept open by the water from the mass of chalk behind, which drained under ground into and kept open the estuary. The amount of water to be obtained from the chalk strata, of which there was altogether nearly four thousand square miles round London, was not only sufficient for London, but for the supply of six or seven times its present population, without disturbing or interfering with the supply of water in other districts. He thought that a very important fact to be kept in mind during the present agitation of the question of the water supply of London.

Professor D. T. Ansted (Visitor) said that as he had not had an opportunity of reading the Paper it would be almost impossible to discuss it fairly, and therefore any observations which he might make would be of a somewhat general character. He quite agreed with Mr. Lucas as to the importance of this question, although he could not say that his views on it were such as recommended themselves to any great extent to those who had examined this subject with attention. At the same time he fully recognized the great amount of information to be obtained from the careful and numerous observations made by Mr. Lucas in various parts of the country. Records of wells were of the utmost

importance with reference to the water enquiry, and therefore whatever Mr. Lucas said, he (Professor Ansted) was inclined to weigh very carefully indeed.

The author of the Paper was strongly convinced that there were certain lines which could be drawn indicative of the level of the underground water. No doubt such lines could be drawn in some cases with tolerable precision, but whether those lines, when drawn, meant anything of appreciable value to those who were searching for water in the chalk, he was inclined to doubt. He could not help thinking that Mr. Lucas had hardly considered sufficiently the extreme differences in the nature of chalk, even within a very limited area. For instance, in a locality which he could name, water could be obtained at a level of 100 feet above Ordnance Datum, and in another place, not 100 yards distant, water was reached at a level of 150 or 190 feet above Ordnance Datum. This was only one out of many instances which he could give of the great differences of the water-level in chalk; and, although there was no great difficulty in drawing a line indicating intercepting causes, the line would be extremely irregular, and would zig-zag in such a way as to be of little use for practical purposes.

The movement of the water through the chalk was very slow and irregular, and depended mainly on the nature and number of the fissures and faults. It filled up the fissures very slowly, although it passed through them very rapidly, and a great deal of rotten chalk was formed—in some cases by weathering, and in other cases by squeezing movements or lateral pressure, and, in some cases, by local disturbances of level, which left the general mass of chalk unaffected. To these causes were attributable the very great differences in the water-level in the chalk—differences so great as, in his opinion, to preclude the possibility of drawing continuous lines indicative, for practical purposes, of the height above

Ordnance Datum at which the underground water might be supposed to stand.

He believed that the theory that a large supply of water was obtainable from all parts of the chalk was now entirely given up; and Mr. HOMERSHAM had expressed an opinion that water could be obtained from it in certain places only; although he believed that Mr. HOMERSHAM at one time thought that water might be obtained from it more regularly, with more certainty, and in larger quantities than was now found to be the case. No doubt, in some cases, there existed lines of rotten chalk, connected, perhaps, with other and distant lines of broken or pervious strata, containing large quantities of water; and, when these lines could be penetrated, a good deal of water might be obtained. These areas of rotten chalk and chalk fissures were, in course of time, considerably affected by continuous and exhaustive pumping, and this was, he believed, the explanation of the gradual lowering of the underground water level of the London Basin to which reference had so frequently been made.

The chalk water of the London Basin was probably drawn from fissures situated within a very limited area, and, as the water did not move very quickly, it was taken away faster than it was supplied. The large majority of wells in the neighbourhood of London were shown, beyond all doubt, to be very much lowered of late years by pumping, proving to his mind that, so far at any rate as the Metropolis is concerned, the supply of water from the chalk is strictly limited. Nor was this the case alone with the portion of the chalk covered by the London clay. He believed that it would be found that the supply was limited even in the open chalk, much more limited than Mr. LUCAS seemed to suppose, and that it moved with extreme slowness, except where the rock was much disintegrated by casual disturbances. He hoped

that Mr. Lucas would continue his interesting investigations, which could not fail to be of great value in the ultimate elucidation of this important subject.

The Rev. J. C. Clutterbuck (Visitor) was disposed to think that the water contour lines on Mr. Lucas's maps more accurately represented the surface of the subterranean water in the chalk than Professor Ansted seemed to suppose. He might state his experience with reference to a well in the Hampstead Road. His observations of that well commenced about the year 1840, and he had in his possession the daily records of the height of it for 10 years. The depression of the water-level in that well was found to be gradually progressive, though modified to a certain extent by the amount of rainfall; and he would undertake, from the measurements alone, to construct a calendar showing all the great festivals for those ten years—Easter, Christmas, and Whitsuntide—as well as the days of the week and seasons of the year, by means of the variations in the level of the well caused by the cessation or diminution of pumping. When they were pumping hard at Reid's Brewery, in Liquorpond Street, where the well was assisted by adits driven horizontally 100 ft. into the chalk, he could tell, almost to an hour, when the pumping began and ceased, although there was at least a mile between the well at Hampstead Road and the well at Reid's. This was vouched for by the late Mr. F. Braithwaite.

He entirely disagreed with Mr. Homersham's remarks as to the salting of water in wells near the coast. Only a few days since, he came across an old letter which he had received many years ago from Sir Adolphus Dalrymple, who was at that time about to sink an artesian well at Brighton, close to the sea. He (Mr. Clutterbuck) warned him that the water would certainly be salted, and that he was

throwing his money away. The man who was carrying out the work, however, was exceedingly anxious for pure water, and was sanguine of the result, but, on reaching a point a little below the level of the tide, the water was found to be as salt as the sea. Sir Adolphus Dalrymple informed him that whenever he pumped hard in his well at Brighton, the water began to get salt—in fact, the drainage was reversed. The inland water occupied an inclined plane, and the pressure from this water, at a certain depth, was not sufficient to keep out the sea.

As regarded the level of the subterranean water generally, it would be found that in Hertfordshire, where he had investigated the subject very closely, the water lay at an inclination of 14 feet in the mile towards its outfall.

He was very much inclined to doubt the authenticity of the facts alleged with reference to the well in Trafalgar Square. He remembered that, in a Paper (by Mr. Amos he believed), there was an admission that there was a depression of the water in that well, and he had in his own possession some diagrams which showed the gradual sinking of the water from 1832 to 1850. It was possible that the rate of depression had now diminished; at any rate, the fall would be much less rapid than formerly, owing to the increase of pressure as the well sank. It would be seen by the diagrams and by Mr. Lucas's tables that the artesian wells (or, as he had ventured to call them, the artesioid wells) in London were comparatively valueless as compared with former times. In his letter to Sir John Sebright in 1860 he had ventured to predict this result if excessive pumping were persisted in. No doubt, considerable information would be gained as to the effects of pumping if there could be a general cessation of pumping, by arrangement, from Saturday night to Monday morning, when a well like that in the Hampstead Road, where as a rule there was no pumping, would show the

depression caused over the whole underground water-level of London. He and his late friend Mr. Arthur Barclay (who was the head of the great brewing firm) examined all the country about Dorking with reference to the water, and he suggested to Mr. Barclay whether it would not be possible to induce the people of London to give a holiday to the wells, so as to see what the effect would be. Mr. Barclay made some attempt to carry out the suggestion; but there were so many difficulties in the way of securing anything like a general agreement, without which the experiment would not have been satisfactory, that the idea was abandoned.

In conclusion, he believed the essential part of Mr. Lucas's Paper to be correct, and to be confirmed by his own experience.

Mr. Baldwin Latham (Visitor) said Mr. Lucas, in his Paper, appeared to treat every elevation of the chalk below the level of the surface of the ground as an anticlinal, and every depression as a synclinal. He (Mr. Latham) thought, for his own part, that most of these elevations and depressions were caused by denudation before the tertiary beds were deposited on the surface of the chalk. In fact, the original valley of the Thames appeared to have been a valley before the land was raised above the water-level.

If we were to take the county of Hertford, with its hills and valleys, its depressions and elevations, and cause it to subside, and cover it with clay or other alluvial deposit, would any one say, on boring down to these hills or valleys, that every hill in that county was an anticlinal and every valley a synclinal? Most of those valleys in the chalk were, as he had said, caused by denudation, and the silting up had taken place at a later period, before the land was elevated.

As regarded the flow of underground water, it was one

thing to make measurements of wells, and so delineate their lines of water-level, but it was another and a totally different thing to argue that such measurements were of service in determining whether large supplies of water could or could not be obtained in one particular district. The delineation of the surface of the water might serve to show how the water was moving, but it was no indication of the volume of the water. As a general rule, where the fall was the least, there the most water would be obtained, for the simple reason that the slope of the water was the measure of the resistance to its flow through the interstices of the strata, and not, as Mr. Homersham had said, the water was held up by the existence of faults, or dikes, which held the water up in a series of steps or reservoirs, one above the other.

A larger amount of rain fell on the higher grounds than on the lower, and under the greater elevations the highest water-level was observed. The water gradually fell from the highest point to the natural point of outlet. Exactly the same thing took place when the chalk was covered by the tertiary beds; but when wells were sunk within the area covered by London clay the chalk was compressed by the superincumbent weight of the surface beds, less water would be obtained, as the water did not flow so freely through these compressed beds, and also for the simple reason that the whole of it had to travel a considerable distance from the outcrop, *i.e.*, the area of chalk not covered. The rain that fell upon the London clay flowed off the surface down to the rivers, and did not penetrate to the chalk; and where a well was located at a considerable distance from the point of outcrop, it was necessary, in order to obtain a large quantity of water from that well, to resort to much more extensive works than in cases where the chalk was exposed. At the Uxbridge Water-works, where the chalk was covered, the pumping of half-a-million gallons

of water in 12 hours caused a depression of 100 ft. between the times of starting and of leaving off pumping. Take, on the other hand, the case of Croydon, where no impervious beds covered the chalk; they were pumping about three million gallons a day, and the depression never exceeded 20 ft. Six times the quantity of water was obtained in the one case, as compared with the other, with only about one-fifth of the depression; the reason for the difference being that, in the case of Uxbridge, the stratum was more dense, and the water had to flow a greater distance to the point of extraction.

Another noticeable fact in connection with wells, where they were numerous within the areas in which the chalk was covered with impervious beds, was the marked effect which pumping at one well had upon the other wells, as compared with the smallness of that effect where the wells were situated in the open chalk. A well sunk in the open chalk did not affect, to any great extent, the wells above it; but it no doubt affected all the wells below it.

*Apropos* to the effects of pumping, he might be permitted to allude to the scheme before Parliament to sink a number of wells round London, to abstract water from the surrounding districts, for the supply of the Metropolis. There was not one of the proposed wells within the Metropolitan area. These wells would interfere most materially with the supply of the water in the districts in which they were sunk, and it was fair matter of question whether powers ought to be conferred upon the Metropolitan Board, enabling them to thus deprive those districts of their natural and only sources of water-supply.

The information collected by Mr. Lucas and others proved that water under ground obeyed exactly the same laws as water above ground, and therefore needed as much protection as regards rights of enjoyment. The value of

hydrogeology was that it went to show that all water obeyed the one great law of gravitation, and would always tend towards its natural outlet.

As regarded the sinking of wells on the sea-shore, no engineer in his senses would dream of sinking his well so low in the chalk near the coast as to run the risk of an influx of salt water. If it were sunk too low, the inevitable result of pumping would be an influx of salt water. As a rule, in cases of the kind, engineers drove in adits at about the level of the mean tide, some distance from the sea, so as to restrict, as far as possible, the back flow of the water from the sea to the wells.

The water of a well in one of the towns mentioned by Mr. Homersham had been analysed, and was found to contain 20 grains more salt at night after a day's pumping than in the morning when pumping commenced, a fact which entirely corroborated the views of Mr. Clutterbuck. That matter had been discussed over and over again, and Professor Faraday corroborated Mr. Clutterbuck at the Institution of Civil Engineers, and showed that, if pumping were carried on exhaustively in London, there was no reason why the Thames water should not run back and make up the deficiency in the Metropolitan wells. It might be possible to prove by analysis that the result predicted by Faraday was actually taking place, and, indeed, it was difficult on any other hypothesis to account for the difference between the quality of the water taken from the chalk under London and that of the water taken from the open chalk. No doubt also, as had been shown by Dr. R. Angus Smith, when rain fell, the largest amount always fell on the tops of the hills; but the most remarkable fact was, that the rain at these higher altitudes contained a large amount of carbonic acid, which acted chemically on the chalk and made it more porous, so that yearly, from the solvent action

of the water, the percolation of water through the chalk might be expected to increase.

Mr. W. Topley (Visitor) considered that the most valuable part of Mr. Lucas's Paper was the Appendix. He might be permitted to make a single observation with respect to the well in Trafalgar Square. He believed that the water of that well was mainly derived from the tertiary strata, which might perhaps account for the anomalous results referred to by previous speakers.

Mr. Lucas, in reply, said, with regard to Professor Ansted's remark as to the irregularity of the surface of the water in the chalk, it was no doubt true that, if a place had, say, 25 or 30 wells in it close together, irregularities to the extent of two or three feet in the level of the water would exist, but he never met with anything more, particularly in the very short distance of 100 yards mentioned by Professor Ansted; and he should like to know where that place was. The greatest fall he had ever met with was upwards of 155 feet in half a mile, at Kingsdown, Kent, a little east of the Darent.

He could not admit that the surface of water was not capable of being contoured, or that water between any two intermediate wells would not rise to a line joining those two; you might have to go a good deal below that line before you struck a water-bearing fissure, but when it was got it rose to that line. He agreed with Mr. Latham that the less the gradient the greater the quantity, and had expressed the converse case in his Paper last year.*

The anticlinals and synclinals described by him in the Paper were not ridges and valleys, as suggested by Mr. Latham, as might be seen from sections drawn on a true

* "Transactions," Vol. IX., p. 160.

scale, and also from the fact that the various beds in the tertiary strata above were affected by the same folds.

The chemical question was rather a difficult one, and the suggestion made by Mr. Topley would not explain it, because the qualities of the water in different parts of London varied much. The special feature about the water was the absence of carbonate of lime, and the presence of a large quantity of salt that struck persons not versed in chemistry. He could not help concluding, and he thought it was borne out by the excessively steep gradient down into the vortex from Woolwich Reach, that there must be a copious influx of the Thames itself. In the neighbourhood of Bermondsey there was an influx of a very curious nature. Until lately there were some open tidal ditches, which ran into the gravel, and which had not been effectually closed in, and some of that water got access to the wells in Bermondsey, and poured down the shafts at high tide; he knew that to be the fact in some cases. He thought that might help to explain the peculiar character of the water.

He might mention, as Mr. Homersham pointed out to him last year, the case of the Harrow Water-works, which was remarkable. The water was conspicuous for the absence of carbonate of lime, and the presence of certain salts, which were not found in chalk water proper.

He did not know that he had more to add beyond thanking the Meeting for the kind attention which had been given to his Paper.

The President said he was sure he was expressing the sense of all present when he said how much they were indebted to Mr. Lucas for the pains that he had taken in preparing his Paper, and for the series of facts that he had ascertained and published. Everything tending to aid them in understanding the Hydrogeology of this district must

interest them especially, as it, indeed, interested the whole of the inhabitants of the south of England.

He felt that, after the exhaustive observations of the several professors and experts who had been so good as to aid them that evening, he was wholly unable to add anything of interest to the discussion. He had had considerable opportunities of ascertaining the absence of any effect from the contiguity of the sea in the coal districts on the east coast, and there was no evidence of the sea affecting the coal measures 1,600 feet under high tide. On the contrary, in the upper portions of that district, the coal was within about 400 feet of the sea, and the sea had not affected it at all. But the coal measures were providentially impervious, while the chalk became apparently saturated with sea water.

The vote of thanks having been carried by acclamation, the Meeting then adjourned.

# MR. LUCAS'S TABLES ILLUSTRATING HYDROGEOLOGY OF MIDDLESEX, &c.

## TABLE I.—MIDDLESEX EXTRA-METROPOLITAN.

N.B. + means *above*; — *below*. Heights in feet.

[To accompany Vol. X., Part XI.

| NAME OF WELL. | Height. Ground + or — O.D. (approximate). | DEPTHS. Shaft. | Bore. | To Chalk. | In Chalk. | Total. | Top of Chalk + or — O.D. | Height to which Water rose when first sunk. Date. | + or — Ground. | + or — O.D. | WATER-LINE. Date. | + or — Ground. | + or — O.D. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ICKENHAM PARISH— | | | | | | | | | | | | | |
| Public Well | 138 | 64 | 80 | 64 | 80 | 144 | +74 | 1865 | | about +140 | does not | now overflow | |
| RUISLIP PARISH— | | | | | | | | | | | 1877 | | |
| *(Near Trinity Church)* | | | | | | | | | | | | | |
| National School | 260 | | | | | 98 | | | | | June 28 | —79.8 | +180 |
| Green Lane | 224 | | | | | 67 | | | | | | —37 | +187 |
| True Lover's Knot | 204 | | | | | 22.3 | | | | | | —14.3 | +190 |
| Nicholl's | 204 | | | | | 34 | | | | | | —17.6 | +187 |
| Kiln Farm | 210 | | | 34 | | 34 | +176 | | | | | —24 | +186 |
| Cottage | | | | | | 42.6 | | | | | | —25.6 | |
| Row Houses | 201 | | | 26 | | 48.6 | +175 | | | | | —26 | +175 |
| Kirby Hall | 192 | | | 14 | | 30 | +178 | | | | | —8.6 | +182 |
| Cottage | 190 | | | 14 | | 30 | +176 | | | | | —10.6 | +180 |
| New Farm | | | | | | 73 | | | | | | —66.2 | |
| The Woodman | 162 | | | | | 57 | | | | | | —25 | +137 |
| Public Well near The George | 154 | 15 | 90¾ | 75¾ | 30 | 105¾ | +78 | | to surface | | | | |
| HARROW PARISH— | | | | | | | | | | | | | |
| Alperton | 116 | 195 | 205 | 218 | 182 | 400 | —102 | 1856? | 35 | 81 | (to pump | stage 20 | ft. |
| Brewery and Water-works | 185 | 160 | | | | 360 | | | | | July 27, '77 | —103 | +82 |
| Aspen Lodge | 248 | 153 | | 206 | | 268 | +42 | 1843 | —135 | +113 | 1859 | —141 | +107 |
| | | | | | | | | | | | filled up | | |
| *Harrow*—Water-works | 226 | 193½ | | 158½ | 254 | 412½ | +68 | 1867 | —125 | +101 | | | |
| Lowlands | 250 | 139 | | 181 | | 366 | +69 | 1843 | —140 | +110 | | | |
| KINGSBURY PARISH— | | | | | | | | | | | | | |
| Redhill Farm | 202 | 180 | into | chalk | | | | | | | to pump | stage 101 | ft. |
| *The Hyde*—Springfield House | | | | | | | | | | | | | |
| *Kingsbury Green*—Kingsbury House | | | | | | | | | | | | | |
| EDGWARE PARISH— | | | | | | | | | | | | | |
| Edgware P.W. | 188 | 90 | 201 | 140 | 151 | 291 | +48 | | | | 1872 | —90 | +98 |
| "Mr. Day's" | | | | 290 | 45 | 335 | | | 40 | | | | |
| HENDON PARISH— | | | | | | | | | | | | | |
| Hendon Union Workhouse | 167 | | | | | | | | —50 | +117 | 1850 | —56 | +111 |
| *The Hyde*—Crooke's Brewery, formerly Mr. Robb's | 158 | | | 100.10 | 37 | 137.10 | +57 | | | | 1877 Nov. 20 | to pump | stage 50ft |
| | | | | | | | | | | | below sta | ge while | pumping |
| "Mr. Booth's" | | | | 244 | 132 | 376 | | | —96 | | | | |
| SOUTH MIMS PARISH— | | | | | | | | | | | 1877 | | |
| Public Well | 326 | | | | | 104 | | | | | June 16 | 80.10 | 245 |
| Warren Gate T.P. | 255 | | | | | 59 | | | | | „ 16 | 25.2 | 230 |
| ENFIELD PARISH— | | | | | | | | | | | | | |
| Brooklands | 65 | | | 130 | | | —65 | | over | flowed | | | |
| Nassau House (about) | 70 | to sand | spring | | about | 115 | | 1832 | —26 | +67 | | | |
| *Ponder's End*—opposite Nag's Head Lane | 56 | 23 | | 97 | 131 | 228 | —41 | 1867 | | | Feb.,'78 | —12 | +44 |
| Water-works | 40 | | | 101 | 219 | 320 | —61 | 1854 | | | Jan.,'78 | —2 | +38 |
| London Jute Company | 45 | 4 | | 112½ | 290½ | 403 | —67 | 1868 | over | flowed | | | |
| EDMONTON PARISH— | | | | | | | | | | | | | |
| Nightingale Hall Farm (garden) | 41 | | | | | | | | | | 1878 | +5¼ | +47 |
| Do. do. do. (field) | 41 | | | | | | | | | | 1878 | +5½ | +47 |
| Moathouse Farm | 41 | | | | | | | | | | 1878 | +6 | +47 |
| Gas-works | | | | 119 | 101 | 220 | said to | flow 4 ft. | above gr | ound wh | en pumpi | ng ceases | at wwks |
| Betstile | 191 | 142 | | | | 300 | | | | | Oct. 1872 | | +54 |
| TOTTENHAM PARISH— | | | | | | | | | | | | | |
| *Wood Green*—Printers' Almshouses | 112 | | | | | | | | | | 1878 Feb. 28 | —77½ | +34 |
| | | | | | | | | | | | to pump | stage 79 | ft. |
| *Tottenham*—Warne & Co.'s India-rubber Works | 30 | 65 | | 147 | 174 | 321 | —117 | | | | June, '74 | —27 | +3 |
| *The Hale*—Waterworks | 30 | | | 153 | 100 | 253 | —123 | 1852 | | | | | |
| HORNSEY PARISH—The Priory | 145 | 150 | 75 | 225 | | 225 | —80 | 1833 sandspri | —70 ng? | | to pump | stage 85 ft. | |
| | | | | | | | | | | | 1878 | —130? | |
| WILLESDEN PARISH— | | | | | | | | | | | 1877 | | |
| *Harlesden*—Crown Inn | 146 | 160 | 200 | | | 360 | | | | | July 25 | —99 | +47 |
| | | | | | | | | | | | to pump | stage 106 | ft. |
| Green Man | 150 | 95 | | | | 374 | | | | | closed | | |
| *Stonebridge*—Coach and Horses | 86 | | | | | | | | over | flowed | | | |
| *Chapel End*—Jakeman's, late Killby's | 127 | 100 | | 273 | 97 | 370 | —146 | | —30 | +97 | 1869 | —57 | +70 |
| Willesden Green Farm | 155 | 245 | | 343 | | | —188 | 1837 | | | Sept. 8,'75 | —102 | +53 |
| | | | | | | | | | | | to pump | stage 86 | ft. |
| | | | | | | | | | | | 1st spring | 308 | |
| Willesden Paddocks | 205 | 182 | | 249 | | 287 | —44 | 1846 | | | to pump | stage 110 | |
| *Neasden*—J. W. Prout, Esq., Neasden House | | | | | | | | | | | | | |
| The Grove—Hopkinson | 164 | 120 | 100 | | | 220 | | | | | to pump | stage 90 | |
| NORTHOLT PARISH— | | | | | | | | | | | | | |
| *West End*—Fordham's, late Danl. Gurney's | 116 | | | 146 | | 260 | —30 | 1853 | —8 | +108 | | | |
| *Village*—Public Well | 120 | | | 134 | | 234 | —14 | 1848 | | | | | |
| *Greenford Lane*—Hare & Hounds | 112 | 19 | | 180 | 60 | 240 | —68 | | —4 | +108 | June 26,'77 | —16 | +96 |

| NAME OF WELL. | Height. Ground + or — O.D. (approximate). | DEPTHS. Shaft. | Bore. | To Chalk. | In Chalk. | Total. | Top of Chalk + or — O.D. | Height to which Water rose when first sunk. Date. | + or — Ground. | + or — O.D. | WATER-LINE. Date. | + or — Ground. | + or — O.D. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GREENFORD PARISH— | | | | | | | | | | | | | |
| Greenford House | 65 | | 195 | | | 195 | | 1867 | | | 1877 | +25 | +99 |
| Manor Farm { *a* | 94 | | | 150 | | | —55 | | | | June 26,'77 | —5½ | +88½ |
| Manor Farm { *b* | 95 | | | 151 | | | | 1876 | —1½ | +93½* | | | |
| Rectory | 64 | | | | | | | | | | | | |
| *Greenford Green*—Colour Factory | 95 | 60 | | 98 | | | —3 | | over | flowed† | | | |
| Mr. Perkin's Stables | 132 | 58 | | | | 360¼ | | | | | June 26,'77 | —46 | about |
| Greenford Place | | | | 172 | | 176 | | | | | | | |
| HILLINGDON PARISH— | | | | | | | | | | | | | |
| *Gould's Green*—Dawley Court | 144 | 19 | | 231 | 88 | 319 | —87 | 1839 | —27 | +117 | | | |
| *Cobham Green*—Uxbridge Union | 51 | | | 175 | 38 | 213 | | | —29 | | April 11,'78 | —39 | |
| *Uxbridge*—Hillingdon End | 140 | | | 109 | 30 | 139 | +31 | | —19 | +121 | | | |
| HAYES PARISH— | | | | | | | | | | | | | |
| *Yeading*—Manor Farm | 104 | 44 | | 174 | | 222 | —70 | 1848 | overflowed 2½ gallons a minute | | July 24,'77 | —11 | +93 |
| *Hayes Village*—opposite (?) Adam and Eve | 127 | 27? | | 173 | 42 | 215 | —46 | | —10 | +117 | | | |
| *Hanwell*—County Lunatic Asylum | | 230 | | 290 | 30 | 320 | | | overflowed 100 gallons a minute | | | | |
| HANWELL PARISH— | | | | | | | | | | | | | |
| Mr. White's‡ | | | | | | 370? | | | | | | | |
| *Brentford*—Ealing Deanery School | | | | | | 225? | | | over | flowed | | | |
| Sexton's | | | | 323 | 2 | 325 | | | over | flowed | | | |
| EALING PARISH— | | | | | | | | | | | 1877 | | |
| Hanger Vale | 132 | | | 368 | | 400 | —236 | 1841 | | | July 27 | —14.8 | |
| Castlebar Hill | | | | 360 | | 360 | | | | | to pump | stage 73 | ft. |
| ACTON PARISH— | | | | | | | | | | | 1877 | | |
| Friar's Place Farm | 94 | 101 | | 315 | | 700 | —221 | 1825 | —40 | +54 | early | —77 | +17 |
| | | | | | | | | | | | July 25 | —9½ | +0 |
| The Steyne | | | | | | | | | | | | | |
| *East Acton* | | | | | | | | | | | | | |
| Goldsmith's Arms | | | | | | | | | | | | | |
| Mr. Markwaite's, formerly Mr. Engleheart's | 48 | 75 | | 284 | 119 | 403 | —236 | 1824 | —12 | +36 | July 27,'77 | —56.10 | +11 |
| Miss Simpson's | 44 | | | | | | | | | | July 27,'77 | —67½ | —23 |
| Stud Farm, formerly Davis's | | | | 267 | 68 | 335 | | 1825 | | | | | |
| Late B. Acton's | 30 | | | 229? | | | —199 | | | | | | |
| *Acton Vale*—Oldfield House | 24 | | | 233 | | 256 | —209 | 1843 | closed | | | | |
| HESTON PARISH— | | | | | | | | | | | | | |
| *Hounslow*—Mr. Salmon's | 60 | | | | | 412 | | | over | flowed | 1850 | —4 | +56 |
| | | | | | | | | | | | green | sand at | bottom |
| *Spring Grove*—Osterley Lodge | 86 | 47 | | 415 | | 435 | —329 | | "water | rises in | shaft" | | |
| *Norwood*—Norwood Court, at former Vitriol Works | 95 | 280 | | 325 | 89 | 414 | —230 | 1825 | over | flowed | | | |
| ISLEWORTH PARISH— | | | | | | | | | | | | | |
| Syon House | 15 | 15 | | | | 543 | | 1829 | +5 | +20 | | | |
| Isleworth Brewery (Farnell Watson) | 24 | 120 | | 364 | | 404 | —346 | | | | | | |
| Formerly Wilmot's | 27 | | chalk | not reach | ed | 327 | | | | | | | |
| Isleworth House | 20 | | | | | 330 | | | over | flowed | probably | into chalk | |
| St. Margaret's | 20 | | „ | „ | „ | 272 | | | +30 | +50 | | | |
| "Mr. Stanborough's" | 20 | | „ | „ | „ | 386 | | | | | | | |
| BRENTFORD PARISH— | | | | | | | | | | | | | |
| Mortlock's | 25 | | | | | | | | | | | | |
| The Beehive, formerly Gomm's | 25 | | | | | | | | | | to pump | 30 | ft. |
| Spring Gardens ("Mr. White's") | 32 | | | 309 | 28 | 337 | —277 | 1834 | | | | | |
| Royal Brewery (Gibbon & Croxford) | 25 | | | | | 260? | | | | | 1877 July | [—15 | —10] |
| | | | | | | | | | | | | after | pumping |
| | | | | | | | | | | | | —48 | —23 |
| Distillery Estate, formerly Booth's | 38 | 30 | | 315 | 53 | 368 | —277 | 1824 | +3 | +41 | | | |
| CHISWICK PARISH— | | | | | | | | | | | | | |
| Horticultural Gardens, now Mr. Watts's, Royal Avenue § | | | | | | | | | | | | | |
| Lamb Brewery *a*§ | | | | | | | | | | | | | |
| Do. do. *b*§ | | | | | | | | | | | | | |
| Do. do. *c*§ | | | | | | | | | | | | | |
| Griffin Brewery§ | | | | | | | | | | | | | |
| STAINES PARISH— | | | | | | | | | | | | | |
| Ashby's Brewery | 54 | | | 369¼ | 154 | 523¼ | —315 | 1850 | +9 | +63 | | | |
| LITTLETON PARISH— | | | | | | | | | | | | | |
| Littleton House *a* | 42 | | | | | 500 | —570 | 1835 | +16 | +58 | | | |
| Do. Do. *b* | 42 | | | 612 | | 653 | | 1873 (1877 | +4½ flows the | +46½ same) | | | |

* A trench was cut to a depth of five feet below surface, and the water run through a pipe at that height, giving 50 gallons a minute.

† "First sand spring 80 ft. from surface. Brought water to the surface at 120 ft."—*Kemsley*.

‡ Said once to have risen to top of house. Now runs out of a pipe near bridge over Brent.

§ See "Journal of Society of Arts," May 11th, 1877.

# Table II.—Middlesex Metropolitan.

[To accompany Vol. X., Part XI.

| NAME OF WELL. | Height. Ground + or — O.D. approximate. | Diameters. Shaft. | Diameters. Bore. | DEPTHS. Shaft. | DEPTHS. Bore. | DEPTHS. To Chalk. | DEPTHS. In Chalk. | DEPTHS. Total. | DEPTHS. Top of Chalk + or — O.D. | Height to which water rose when first sunk. Date. | Height to which water rose when first sunk. + or — ground. | Height to which water rose when first sunk. + or — O.D. | Depth of Pumps and Suction. Pumps. — ground. | Depth of Pumps and Suction. Suction. — ground. | Depth of Pumps and Suction. Suction. + or — O.D. | WATERLINE. Before Pumping. Date. | Before Pumping. — ground. | Before Pumping. — O.D. | After Pumping. — ground. | After Pumping. — O.D. | Difference. | No. of hours. | Gallons per hour. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Hammersmith Parish—** | | | | | | | | | | | | | | | | | | | | | | | |
| Wormwood Scrubs | 40 | | | | | 250 | 116 | 366 | —210 | 1824 | —5 | +35 | | | | | | | | | | | |
| *Shepherd's Bush*—Wood House (Mr. Brydge's) | 22 | | | | | 252 | 66 | 318 | —230 | | over flowed | | | | | | | | | | | | |
| Mr. Aldridge's | | | | | | | | | | | over flowed | | | | | | | | | | | | |
| Springvale Works | 18 | | | 82 | | 252 | 66 | 318 | —234 | 1824 | +14 | +32 | | | | July 12, '77 | —40 | —22 | | | | | |
| *Brook Green*—Mr. Bird's | 16 | | | 30 | | 264 | 70 | 336 | —248 | 1823 | +17½ | +33½ | | | | | | | | | | | |
| *Ravenscourt Park*—(Mr. Scott's) | 17 | | | 30 | | 232 | 72 | 304 | —255 | 1823 | +25? | +42? | | | | | | | | | | | |
| The Thatched House, P.H. | 13 | | | 45 | | 257 | 56 | 313 | —244 | | | | | | | | | | | | | | |
| St. Peter's Square | 20 | | | 155 | | 252 | 66 | 318 | —232 | | | | —33 | —63 | —43 | July 12, '77 | —44 | —24 | | | | | |
| *South Street*—Mr. Bird's, formerly Mr. Brooks's | 18 | | | | | 246 | 65 | 311 | —228 | | | | | | | | | | | | | | |
| *Lower Mall*—Mr. Dortnell's | 17 | | | | | 250 | 68 | 318 | —233 | | +11 | +28 | | | | | | | | | | | |
| *Queen Street* (Mr. Cockett's) | 22 | | 8 | | | | | 346 | | 1829 | | | | | | 1854 | 25 | 3 | | | | | |
| *Great Church Lane*—Hoare's | 18 | | | | | 270 | 114 | 384 | —252 | 1825 | | | | | | | | | | | | | |
| *Bridge Road*—Worsencroft's | 17 | | | | | 268 | | 300 | —251 | 1843 | —1½ | +15½ | | | | | | | | | | | |
| *High Street*—Messrs. Cloud's | 18 | | | | | 283 | 58 | 341 | —265 | | | | | | | | | | | | | | |
| **Fulham Parish—** | | | | | | | | | | | | | | | | | | | | | | | |
| Fulham Palace | 15 | | | 27 | | 250 | | 370 | —234 | 1824 | +7½ | +22½ | —24 | —52 | —37 | April, 1877 | about —50 | —35 | | | | | |
| *Parson's Green*—Bell's Brewery | 13 | | | 60 | 240 | | | 300 | | 1833 | over flowed | | | | | | | | | | | | |
| *Walham Green*—Swan Brewery | 14 | | | | | 231 | | 333 | —217 | 1825 | +10 | +24 | | | | closed 15 years obsolete | | | | | | | |
| Farm Lane | 13 | | | | | | | 365 | | | | | | | | | | | | | | | |
| "Sir John Lillie's" (Lillie Road) | 16 | | | | | | | 405 | | | | | | | | | | | | | | | |
| **Kensington Parish—** | | | | | | | | | | | | | | | | | | | | | | | |
| *Notting Vale*—Bird's Potteries | | | | | | 244 | 12 | 256 | | | | | | | | | | | | | | | |
| At Norland Terrace, formerly Norland House | | | | 236 | | | | 260 | | 1794 | over flowed | | | | | | | | | | | | |
| *High Street*—Mr. Bird's | | | | | | 286 | 135 | 421 | | | —30 | | | | | | | | | | | | |
| St. Mary Abbott's Workhouse | 26 | 4 | | 133 | | 270 | 100 | 370 | —244 | | | | —75 | —103 | —77 | 1849 | —60 | —34 | | | | | |
| | | | | | | | | | | | | | | | | June 1, '77 | —87 | —61 | | | | | |
| **Chelsea Parish—** | | | | | | | | | | | | | | | | | | | | | | | |
| Cremorne Gardens | 18 | | | | | 246 | | 276 | —228 | | | | | | | | | | | | | | |
| *Little Chelsea*—Stephen Bird's | | | | | | 274 | | 312 | | 1846 | —40 | | | | | | | | | | | | |
| *Hyde Park*—Serpentine | 60 | | | 263 | | 263½ | 57¾ | 321 | —203 | | —105 | —45 | | | | | | | | | | | |
| *South Kensington*—Horticultural Gardens | 50 | | | 226 | 175 | 317 | 84 | 401 | —267 | 1862 | —90 | —40 | | | | 1872 | —109 | —59 | | | | | |
| *Hyde Park Corner*—St. George's Hospital | 45 | 5.3 | 12, 9, 4½ | 200 | | 319 | | 337 | —274 | 1870 | —103 | —58 | —126 | —159½ | —114 | | | | | | | | |
| *Pimlico*—Simpson's, Engineer | 17·6 | 6 | 9 | 142½ | | 230 | | 329 | —213 | 1860 | | | | | | Dec. 1860 | | —21 | | —36½ | 15½ | 60 | |
| *Millbank*—Seager, Evans, & Co. | 12½ | 5 | 4 | 115 | | 205 | 100 | 305 | | 1846 | —54 | —41½ | —105 | —112 | —100 | Dec. 14, '74 | | —34 | | —70½ | 36½ | 60 | |
| *Pall Mall*—Reform Club | | 5 | 6 | 120 | 200 | 120 | 200 | 320 | | | | | | | | Apl. 4, '77. 1878 | —73 —105* | —60 | | | | | |
| *Government Water-works*—Trafalgar Square | 43.17 | 4.6 | 7 | 170 from area. | 215 | 250 | 135 | 385 | —207 | 1844 | | —35 | No Pumps. | | | | | | | | | | |
| Orange Street A | 56.9 | 6.3 | 11 | 254.4 | | 252.8 | | 364.4 | —196 | 1849 | | | 236.7 | —246.7 | —190 | 1877 Jan. 13 | —138 | | unusually high | | | | |
| „ „ B | 56.9 | 6 | 14 for 39, 7 for 30 | 174 | 130 | | | 304 | | 1844 | —92 | —35 | —153 | —172½ | —115½ | „ 15 | —137.9 | —81 | | | | | |
| Covent Garden Market | 70 | | | 140 | | 260 | 98 | 358 | —190 | | | | No Pumps. | | | Dec. 28, '31 1846 | —40 —120 | +30 —50 | | | | | |
| *Tottenham Court Road*—Meux & Co. | 85 | | | 210 | | 158½ | | | —73½ | | —93 | —8 | | | | May 29, '77 | —139½? | —70? | more? | | | | |
| | | | | | | | | | | | | | | | | 1843 | —115 | —30 | | | | | |
| | | | | | | | | | | | | | | | | 1872 | —198 | —113 | | | | | |
| | | | | | | | | | | | | | | | | 1874 | dry | | | | | | |
| *Portland Place*—Langham Hotel | 90 | | | 155 | | 167 | | 358 | —77 | 1865 | | | —147 | —175½ | —85 | Apl. 4, '76 | | | —161 | —71 | | | |
| | | | | | | | | | | | | | | | | July 6 | —159.2 | —69 | | | | | |
| | | | | | | | | | | | | | | | | „ 7 | | | —175½ | —85 | | | |
| *Albany Street*—Grimble & Co.'s Distillery | 105 | 5 | 14 | 150 | | 182 | 125 | 307 | —77 | | | | —150 | —178 | —73 | | | | | | Pumps | never lowered | |
| Zoological Gardens | 110 | 7 to 160, 6½ to 182 | 4½, 4 | 182 | | 224.4 | 50 | 274.4 | —114 | | —120 | —10 | —160 | —188 | —78 | June 1, '77 | —171 | —61 | | | 3 | | 2,400 |
| *Haverstock Hill*—Orphan Working School | 170 | | | 230 | | 312 | | 390 | —142 | 1844 | —196 | —26 | | | | | | | | | closed | | |
| *Upper Holloway*—Islington Workhouse | 190 | 4 | | 234 | | 299 | 250 | 549 | —109 | 1869 | | | 248 | —276 | | June, '76 | —209 | —19 | —242 | No | water | from chalk. | |
| Albion Brewery, Santer & Collingwood | 118 | | 11, 6 | 14 | | 188 | 83 | 271 | —70 | 1873 | | | | | | 1877 | —151? | —33? | When | the bore | was deepened in | | 1877. |
| *Caledonian Road*—A. Gordon & Co.'s Brewery | 132 | 5 | 0 | 219½ | 0 | 218 | 1½ | 219½ | —86 | 1861 Apl. 22 | —185 | —53 | —184 | —218 | | 1877 | —194 | —62 | | | | | |
| Pentonville Prison | 134 | 6 | | 170 | | 219½ | 151 | 370½ | —85 | 1844 | | | —180 | —212 | —78 | June 8, '77 | —200 | —66 | —212 | —78 | 12 | 8 | 4,000 |
| *Islington Green*—Webb's Mineral Water-works | 105 | | 9 for 100, 6 | 20 | | 176 | 144 | 320 | —71 | 1842 | —95 | +10 | —180 | —210 | —105 | 1844 | —110 | —5 | | | | | |
| | | | | | | | | | | | | | | | | 1870 | —200 | —95 | | | | | |
| *Gray's Inn Road*—Sir W. Cubitt & Co. A | 60 | 4½ | 12 | 105 | 186 | | | | | | | | | | | | | | | | | | |
| B | | 4½ | 12 | 116 | 184 | | | | | | | | | | | | | | | | | | |
| *Liquorpond Street*—Reid & Co.'s Brewery A | 70 | | | 222½ | 40 | 136 | 126½ | 262½ | —66 | 1842 | —121? | —51? | | | | Sept. 23, '69 | —189½ | —119½ | After | 84 hours' | rest | | |
| B | 70 | | | 222½ | | 136½ | 85.11 | 222½ | | 1844 | —120? | —50? | —195 | —221 | —151 | „ 24 | —205½ | —135½ | After | 24 hours' | rest | | |
| | | | | | | | | | | | | | | | | Apl. 21, '77 | | | —221 | —151 | | | |
| | | | | | | | | | | | | | | | | „ 23 | —200 | —130 | —210 | —140 | | | |
| | | | | | | | | | | | | | | | | „ 24 | | | found | 300 bar- | | | |
| | | | | | | | | | | | | | | | | „ 25 | | | rels | only | | | |
| *Blackfriars*—Keyser's Royal Hotel† | | | | | | | | | | | | | | | | | | | | | | | |
| Apothecaries' Hall | | 5½ | 12 | 122 | | 218 | 76 | 294 | | | | | —90 | —118 | | May 22, '77 | —107 | | | | | | |
| *St. Martin's-le-Grand*—General Post Office † | | | | | | | | | | | | | | | | | | | | | | | |
| *Jewin Crescent*—Warner's Bell Foundry † | | | | | | | | | | | | | | | | | | | | | | | |
| *Chiswell Street*—Whitbread's Brewery † | | | | | | | | | | | | | | | | | | | | | | | |
| *Old Street*—More's Brewery | 65 | | | 102 | | 154 | | 354 | —89 | 1849 | —104 | —39 | | | | | | | | | | | |
| *Lothbury*—Bank of England † | | | | | | | | | | | | | | | | | | | | | | | |
| City of London Brewery † | | | | | | | | | | | | | | | | | | | | | | | |
| *Goulston Street*—The Brewers' Saccharine Company | 55 | 5 | 12 | 280? | | | | 580 | | | | | | | | July 17, '77 | —122 | —67 | | | | | |
| *Mile End Road*—Mann, Crossmann, & Co., Albion Brewery | 40 | in. 8 for 100, 7 for 101 | | 201 | | 201 | 156 | 357 | —161 | 1860 | | | —118 —120 | —146 —150 | —91 —110 | | | | | | | | |
| Charrington, Head, & Co., Anchor Brewery A | 31 | 5 | 8 | 95 | | 196 | | 281 | —165 | | | | —88 | —110 | —79 | | | | | | | | |
| B | | | | | | | | | | | | | | | | | | | | | | | |
| City of London Union | 38 | 4½ | | | | 175 | | 200 | —137 | | | | —60 | —88 | —50 | | | | | | | | |
| *Limehouse*—W. W. R. Johnson, Commercial Road | 29 | 6 | 8, 6 | 90 | | 190 | | | —161 | | | | —44 | —76 | —47 | 1875 | —74 | —45 | | | | | |
| *Bow*—Brewery | 25 | | | 120 | 180 | | | 300 | | | | | —50 | —80 | 55 | 1872 | —60 | —35 | | | | | |
| Starch Works (Berger & Co.) | 35 | | | 176 | | 174 | 150 | 324 | —139 | 1864 | | | | | | | | | | | | | |

* When Houses of Parliament are open, Monday to Thursday, water all day. Thursday to Saturday, pump dry in three hours.

† *See* "Journal of Society of Arts," May 11th, 1877.

TABLE III. CHALK WELLS IN HERTFORDSHIRE, EAST OF THE COLNE.

| | J. L. | | Rev. J. C. Clutterbuck. | | | J. Lucas. | | |
|---|---|---|---|---|---|---|---|---|
| | Height of Ground. Approximate | Depth of Well. | Date | To Water. | Water Line above O. D. | Date. | To Water. | Water Line above O. D. |
| | ft. | ft. | 1874. | ft. in. | ft. | 1878. | ft. in | ft. |
| BUSHEY PARISH— | | | | | | | | |
| Slaughter's Cottage | 240 | 63.7 | Spring | 58 10 | 181 | Jan. 25 | 56 6 | 183 |
| Bushey Grange Farm | 240 | 71.6 | ,, | | | ,, 25 | 59 10 | 180 |
| Burnt Farm | 256 | 88.6 | ,, | 80 7 | 175 | ,, 25 | 79 1 | 177 |
| New Cottages, Hart Spring | | | ,, | 58 0 | | Fallen | in—dry 58 7 | at |
| ALDENHAM PARISH— | | | | | | | | |
| Delrow House | 240 | 65.5 | ,, | 56 1 | 184 | Jan. 25 | 52 2 | 188 |
| Patchett's Green Farm | 250 | 76.3 | | | | ,, 25 | 66 8 | 183 |
| Aldenham Church | | | ,, | 97 8 | | | | |
| Do. Cottages | 250 | 83.5 | | | | ,, 25 | 77 2 | 173 |
| Round Bush | 304 | 132.3 | | | | ,, 25 | 120 7 | 183 |
| | | | 1842. | | | | | |
| Kendal Hall | 295 | | Nov. 9 | 83 6 | 212 | (To Stage | Dry | 84) |
| Phillimore's Farm | | | ,, 9 | 87 5 | | | | |
| Cottages near "Cat and Fiddle" | 275 | 74.3 | | | | Jan. 25 | 67 1 | 208 |
| Shaw's, Radlett | 235 | 46.5 | ,, 9 | 42 8 | 192 | ,, 25 | 33 10 | 201 |
| Cottage, do. | | | ,, 9 | 40 0 | | | | |
| Newburys | | | ,, 9 | 116 8 | | | | |

# CHALK WELLS BETWEEN HITCHIN AND LONDON.—HERTFORDSHIRE.

TABLE IV.—ILLUSTRATING SECTION 3, ALONG THE LINE OF THE GREAT NORTHERN RAILWAY, FROM HITCHIN TO LONDON.

| | Ground above O. D. | Depth of Well. | Date. | To Water. | Water Line above O. D. |
|---|---|---|---|---|---|
| | ft. | ft. | 1877 | ft. in. | ft. |
| HITCHIN— | | | | | |
| G. N. R. Station (two wells) | 218 | 41 | June 14 | 34 8 | 183 |
| A. Ransome, Esq. | | 90 | | | |
| Cottages in Lane leading to Nine Springs | | 63 | ,, | 57 2 | |
| SOUTH OF HITCHIN— | | | | | |
| Preston P. W. | | 213 | July 6 | 150 4 | |
| Temple Dinsley | | 202 | ,, | 159 4 | |
| Hunsdon House | | 219 | ,, | 175 0 | |
| MUCH WYMONDLEY— | | | | | |
| Blake's Farm | | 50 | June 14 | | |
| "Green Man" P. H. (gravel well) | | 46 | ,, | 14 7 | |
| Public Well | | 66 | ,, | 33 2 | |
| Post Office | | 65 | ,, | 38 5 | |
| LITTLE WYMONDLEY— | | | | | |
| Opposite "Plume of Feathers" | | 21½ | ,, | 4 2 | |
| Red Coats | | | ,, | covered | |
| TITMORE GREEN— | | | | | |
| Beech House | | 85 | ,, | 62 11 | |
| TODD'S GREEN— | | | | | |
| Cottages | | 84½ | ,, | 61 6 | |
| FISHER'S GREEN— | | | | | |
| Farm | | 56 | ,, | 51 6 | |
| STEVENAGE— | | | | | |
| G. N. R. Station | 311 | 62½ | ,, | 42 11 | 268 |
| (Tertiary) A | | 34 | ,, | 29 9 | |
| ( ,, ) B | | 14 | ,, | 7 8 | |
| ( ,, ) C | | 15 | ,, | 8 2 | |
| ( ,, ) D | | 18½ | ,, | 5 10 | |
| "Coach and Horses" | | 50 | ,, | 34 10 | |
| SIX HILLS— | | | | | |
| "Our Mutual Friend" | | 57 | ,, | 41 0 | |
| Cottages, S. of | | 53 | ,, | 38 5 | |
| MONK'S BOTTOM— | | | | | |
| Turnpike | 280 | 33 | ,, | 19 2 | 261 |
| KNEBWORTH— | | | | | |
| Deard's End Farm | | 153 | ,, | 141 4 | |
| G. N. R. Signal Box | 324 | 50½ | ,, | 44 8 | 279 |
| Swangley Farm | | 125 | ,, | 106 9 | |
| WOOLMER'S GREEN— | | | | | |
| Legget's Farm | | 112 | ,, | 94 2 | |
| "Chequers" P. H. | 310 | 97½ | ,, | 82 8 | 227 |
| WELWYN— | | | | | |
| Railway Cottages | | 119 | June 15 | 115 0 | |
| G. N. R. Station | 291 | | ,, | To stage, dry | 91½ |
| Railway Hotel | | 95 | June 14 | 91 2 | |
| Digswell Lodge Farm | 310 | 122½ | June 15 | 117 10 | 192 |
| Railway Cottages on Luton Branch | | 97 | ,, | 92 2 | |
| Welwyn Junction | 283 | 78 | ,, | 73 2 | 209 |
| CROMER HYDE— | | | | | |
| A | | 62 | ,, | 55 5 | |
| B | | 63 | ,, | 56 1 | |
| C | | 63 | ,, | 56 5 | |
| D | | 64 | ,, | 57 0 | |
| E | | 66 | ,, | 59 4 | |
| F | | 97 | ,, | 88 4 | |
| Cromer Hyde Farm | | 111 | ,, | 102 10 | |
| "Waggon and Horses" | | 60½ | ,, | 55 3 | |
| HATFIELD— | | | | | |
| G. N. R. Station | 257 | | ,, | 110 8 | 146* |
| Bradmore | 296 | 92 | June 16 | 75 6 | 220 |
| Reeves's | 350 | 140 | ,, | 116 2 | 234 |
| Mimms Park Lodge | 230 | 46 | | 32 11 | 198 |
| NORTH MIMMS— | | | | | |
| "Woodman" P. H. | 252 | 62½ | | 36 1 | 216 |
| Public Well | 251 | 65½ | | 30 7 | 220 |
| "Maypole" P. H. | 250 | 56 | | 31 2 | 219 |
| Abdale House | 225 | 35 | | 26 2 | 229 |
| RIDGE HILL— | | | | | |
| Packhorse Cottages | 360 | 138½ | June 16 | 102 2 | 258 |
| Shenley Lodge | 416 | 205 | ,, | 183 10 | 232 |
| Salisbury Hall | 265 | 57 | ,, | 43 2 | 222 |

* While pumping.

No. 77.]

# THE USE OF SEWAGE BY FARMERS;

OR,

## FIFTY INSTANCES OF PROFITABLE SEWAGE IRRIGATION.

By R. W. PEREGRINE BIRCH (Associate).

*Read at the Ordinary General Meeting of the* Institution of Surveyors, *May 13th*, 1878.

THE PRESIDENT IN THE CHAIR.

The question of sewage disposal has generally been dealt with from a lofty point of view, where gigantic figures are used alike for describing the fortunes that are to be made by one system and those that have been wasted by another. This must be the case so long as powerful financial companies are interested in some of the various methods that have been propounded with a view to helping local authorities out of their difficulties.

In the present Paper, addressed to the Institution of Surveyors (which is understood to represent the management of something like three-fifths of the landed property of England), the subject will be treated from an agricultural point of view. Many of the cases that will be referred to are unknown to the public, for they are not such as would be useful to opposing writers; and it is hoped the best possible reason will be apparent why those most familiar with them should be content for them to remain undiscussed. Articles have been printed in London newspapers and tables have

been published in books upon sewage disposal, one after another, all showing that the attempts of sewage companies and local boards to use sewage, make it portable, or put it out of the way, have alike resulted in an expenditure of upwards of a shilling per head per annum; and this, although sewage contains materials which, but for their encumbrance, would produce an income of ten shillings per head per year to the ratepayer. What has been truly said and written upon the subject has had the effect, as might be expected, of making local authorities cautious and slow to take any action. This is probably as it should be. Let owners or occupiers of agricultural land, however, not be alarmed at the failures of local boards or public companies, but rather see that therein is their opportunity to come forward and help the public with considerable and increasing advantage to themselves. Without going into the too-often-discussed question of whether, speaking generally, irrigation is preferable to the chemical processes as a method of sewage disposal, it may be said that, from an agricultural point of view, it is better worth trying to develop; for, while under extremely favourable circumstances every grain of manure may be extracted from sewage by irrigation, there is not another process by which, under any imaginable circumstances, more than a small proportion of the valuable material contained can be made use of.

In the following pages it will be attempted to show that the use of sewage has proved advantageous to a large number of agriculturists in various parts of Great Britain; and that the arrangements existing between ratepayers and farmers, in the many instances where the latter appear to be satisfied, are more favourable to the ratepayers than what has been done by local authorities, in the way of sewage utilization, upon their own account. If these points

can only be made good, and the Institution of Surveyors pretty well agreed, there can be little doubt that the difficulties of many places will prove to be very much less than those which appear to surround the great question as a whole. If this communication leads directly to a single landowner or farmer using the sewage of a town that has, hitherto, polluted a river, or to two men negociating with a town authority for its sewage, which, hitherto, only one has been willing to take, then the time spent upon it will not have been wasted.

That the use of sewage has proved advantageous to a large number of agriculturists will appear from the following notes, arranged according to the alphabetical position of the initial letter of the place to which each one refers. That the arrangements under which farmers can, and have, used sewage are more favourable to ratepayers than the efforts of their representative boards to do so have yet proved, will be seen from a comparison between these notes and Table No. 1,* which gives the cost of sewage utilization by local authorities. This table has been prepared from Local Government Board reports; but the annual cost of the capital laid out has been taken at 3½ per cent., which is the rate at which money can be borrowed for sanitary improvements. Similar tables, as printed in those reports, would make the comparison appear still less favourable to the local boards, for in them 6 per cent. is allowed for capital expended: this extinguishes the debt in thirty years, although the work may remain effective much longer, while, on the other hand, in any arrangement with a farmer, the purification of sewage, and the payment of money, by whichever side, are coterminous.

At Aberdeen there is an example of sewage utilization, with reference to which a few notes may be worth making,

* See p. 373.

although the authorities there do not profess to have disposed of the whole of their sewage.

The corporation, some seven or eight years ago, made an agreement for nineteen years, with a landowner to supply him with what sewage he required on fifty acres of light land, upon his paying £5 an acre, or £250 a year, for the use of it.

The land was expensively laid out by the owner (£30 or £40 an acre, it is said, having been spent upon it), and for some years expensively managed.

Rye-grass, carrots, and turnips are the principal crops grown, the latter being very valuable, as they are greatly depended upon for cattle feed.

A year or two ago the proprietor attempted to show the corporation, with a view to getting the sewage at a reduced price, that he was losing money by the transaction. To do this he debited the concern with the money he had spent on the land and management. He failed, however, to make good his point, and it is to be hoped that by this time the profit is more decided. But the object of this communication is not to persuade farmers to sink £30 or £40 in an acre of land and then pay £5 a year for sewage to put on it; for a much smaller sacrifice on their part will enable them to offer very satisfactory terms to their urban neighbours.

At Aldershot, some fourteen years ago, Mr. Blackburn levelled and prepared about 100 acres of heath land for the reception of the sewage from the North Camp, which contains an average population of 8,000.

The soil was a blowing sand, not worth, it is said, a shilling an acre; and it is understood that a lease of sixteen years was granted, without any rent, in consideration of the work and money expended by Mr. Blackburn in making the land fit for sewage purposes and starting the farm.

Rye-grass, mangold-wurzel, and potatoes are the principal crops. Part of the rye-grass land has been let to neighbouring cowkeepers at £20 an acre. The potatoes are used largely in the camp. Referring to them, Mr. Blackburn said to a Committee of the House of Lords in 1870: "The whole time I have had the farm I have not had two bushels of diseased potatoes in it."

No record of the cost of preparing the land is to be obtained; but almost the whole of it must be due to levelling the surface, and breaking up and draining the ferruginous "pan" which underlies the soil of this part of the Aldershot waste, for the carriers are of a most inexpensive kind, being merely cut in the ground or "built up of tough sods."

In the growing season, or when a crop is being irrigated, the solid matter is extracted by subsidence, but not when the sewage is being applied to rough ploughed land in winter.

A feature to be borne in mind in the Aldershot farm is a steam pumping engine, which is used, in summer-time, to raise water out of a brook on to the land, and which "has proved most valuable."

At Altrincham, with a population between 12,000 and 13,000, the local board hired, some seven years ago, a farm containing fifty-five acres of light, peaty land, on a lease of twenty years, and at a rent of £4 an acre. This land is suitably situated for the reception of the sewage, and the town, as might be expected, had to pay more for it than its value to an ordinary farmer. Until quite lately, the local board kept it in their own hands, and found their returns fell short of their expenses by about £130 a year. During that time it was found "that the cost of purifying the sewage averaged annually $5\frac{1}{2}d.$ per head of the population contributing, or a rate of $2\frac{1}{2}d.$ in the pound, including the repayment of principal and interest on account of money expended in laying out and draining the land." The farm

is now let "for a term of five years, at a lump rental, which results in a loss to the board of £50 per annum. The tenant takes all the sewage, and clears the board of all liability for pollution of streams, &c., and undertakes to maintain the present levels of the ground." It can be stated here, on good authority, that after the expiration of the existing lease a better rent will be obtained than the present, although that is quite equal to what is paid by other occupiers in the neighbourhood, for superior land.

The number of water-closets in the town may be taken at a fifth or sixth of that of the houses. No provision has been made for excluding surface-water from the sewers, but there is an overflow, which acts in time of storms. The carriers were made of earthenware channel-pipes; but these have now been taken up in favour of simple spade-cut grips. It was not found necessary to alter the surface of the land much, for that was found "pretty well adapted as to fall, &c." The solid matter is taken, by means of a settling-tank, from the sewage before the latter is distributed. There has been no litigation, in respect of this undertaking. Excellent crops have been obtained, "the most suitable being rye-grass, turnips, and mangolds"; but wheat, oats, beans, cabbages, and celery have done well. The town is considered to be satisfactorily free of its sewage difficulty.

At *Bodmin*, in Cornwall, with 4,000 inhabitants, three-quarters of whom are supplied with water-closets, the sewage has for three years been used, without any separation, upon seventeen acres of stiff meadow-land, under an agreement which, though temporary, involves no expense to the rates. The sewage is distributed by means of contour grips cut in the ground.

At Braintree, the sewage of about 5,000 inhabitants has for many years been allowed to flow on the meadows occupied

by several farmers along the side of the River Pont, and until within the last three or four years the suspended matters were precipitated in tanks. Now, however, the precipitation has been abandoned, and the sewage is either distributed on 30 acres of gravelly land, which belongs to the town and is farmed by the Surveyor, or on to the farmer's meadows, which together amount to another 25 acres. Half the board's land is irrigated by gravity, the other half can only be reached by pumping. The whole of it, except a small meadow let at nearly £6 an acre, is arable, and although it has a very irregular but considerable natural slope, it has been very satisfactorily irrigated without any permanent work beyond the iron rising main, the surface being unaltered, and the carriers being ploughed each year in contours. Tremendous crops of mangold are grown and sold by auction in small lots on the ground, realizing first-rate prices. There are cottages within fifty or sixty yards of the sewage land, but no complaints; the occupiers occasionally using the sewage on their own gardens.

At Carlisle, with 21,000 inhabitants, the sewage was let for a nominal sum to Mr. Alexander McDougall on a fifteen years' lease, which terminated in 1874. Mr. McDougall irrigated about sixty acres of gravelly grass land for which he paid £4 an acre, and let at £8 for grazing purposes. The land was not levelled. The sewage was distributed by means of portable wooden spouting.

The sanitary authority, before the termination of this arrangement, were of opinion that sewage irrigation would be a proper and, possibly, profitable thing for them to have in their own hands, and determined to purchase the sixty acres already in use and some adjoining land for the purpose. The necessary steps have been taken, and irrigationwill soon be started again on an extended scale by the corporation.

The late tenant was not bound by his lease to take the

whole sewage, but he could prevent any one else from using it.

A number of suburban villas stands on the high ground overlooking the meadows, at a distance of a very few hundred yards, and more are now being built.

The effluent water was reported by the Rivers Pollution Commissioners to have been effectually purified.

At Chelmsford, the local board some ten years ago leased the sewage of about 8,000 inhabitants to Mr. F. MARRIAGE, who had already had considerable experience of sewage farming at Croydon. Mr. MARRIAGE pays £30 a year for the sewage, and the board has to pump it to the summit of his farm, which is on light, loamy, gravelly soil, and of which about 70 acres are irrigated. The farm lies along the side of the River Chelmer. The upper part, having a considerable slope, is arable; the lower part consists of nearly flat meadows. In April last there were about sixty milking cows in the yard, which are said to be fed during the summer almost entirely on sewage grown rye-grass, and there are a number of beasts grazing in the meadows. These meadows appeared to be full of feed, and of a much greener hue than other land around them.

The solid matter is roughly extracted by means of a wattled screen placed across a pit, through which the sewage passes.

The land is very inexpensively laid out; the surface having been scarcely altered, and the permanent carriers, of which there are very few, consist merely of channels cut in the ground, except where, for the sake of the passage of traffic over them, they had to be made of socket-pipes.

The application of the sewage to the land results in abundant crops of grass, cabbages, and roots; and the experienced lessee has lately been endeavouring to arrange for utilizing the sewage of the entire district of Chelmsford, Springfield, and Great Baddow; but it is understood that the combined sanitary authorities of the district are taking steps

to purchase lands upon which the sewage can be applied by gravity; so that pumping will be entirely dispensed with. No figures are at hand showing the pecuniary results to the lessee, of his present farm, but it has all the appearances of a highly profitable one.

Cheltenham, with a population of nearly 50,000 contributing to its sewage, affords remarkable proof that the refuse of a large town can be used by farmers in its immediate neighbourhood, with considerable advantage to themselves.

Here the corporation, about ten years ago, purchased by private treaty 131 acres of stiff meadow land. The estate, which is situated in the parish of Boddington, about two miles outside the town, cost £80 an acre, including some cottages and timber. The sewage had been for some years previously precipitated with chemicals, in two sets of tanks about a mile apart on the west side of the town; so these tanks were kept in use for settling and straining the grosser suspended matter, and two outfall sewers, amounting together to a length of 9,000 yards, were constructed from them to the new farm. These, together with such laying out as the land required, cost £7,500. The preparation of land consisted principally in subsoil drainage, for the surface has been scarcely altered, and the sewage is distributed over the farm by open contour grips dug in the ground.

Although the two outfall sewers are a foot or two below the surface of the ground in which they are laid, there is a considerable area of lower land close by, on to which it is possible to discharge them at various points. This natural advantage has not been neglected at Cheltenham, for, through the skilful management of the Surveyor, no doubt, and owing to the wisdom of those occupying land near the sewers, more than £100 a year is now received by the corporation for sewage used on private property alone. In this manner sewage is retailed to ten

or twelve different occupiers, for the fertilization of over 300 acres of land, independently of that belonging to the town. Seven shillings per acre per dressing is the rate at which the sewage has generally been poured into private lands; but in one case—that of a large dairy farmer occupying the nearest available land to the town—a standing agreement exists that he shall take a certain proportion of the sewage on to his farm, and pay the town £40 a year. This agreement is not with an amateur or enthusiast, but with a practical farmer who, having had ten years' experience of sewage utilization, is now irrigating about a hundred acres of meadow and arable land of the Arle Court Dairy Farm, and feeding, with the produce of it, 120 head of cow cattle, 90 of which he milks for the supply of Cheltenham. Mangold-wurzel seem to be his favourite root crop, for a large extent of land is devoted to mangold this year which has borne the same crop the last four years. Roots grown on this land, under sewage, won first prizes at the annual show at Cheltenham, till they were excluded from competition with the produce of ordinary farms; they were then shown with equal success, and the same result, at Gloucester. They appear to keep as well as roots grown on unsewaged land, for, in February last, there were many more in stock than would be used by the Arle Court Dairy, and they were being sold at best market price, customers coming for them daily. The sewage was carried from one part of the farm to another in open channels cut in the ground, or, where the ground was too low, in a raised bank of turf. It is worth mentioning that many hundred yards of these channels are cut in meadow land, and the sewage flows and the cattle graze without either, apparently, interfering with the other. The land at Arle Court, so far as this has been done at all, has been prepared at the expense of the occupier, and he does a little in the way of levelling every year.

He keeps a man, whose only duty it is to attend to the flow of the sewage, the surface of the ground, and the condition of the channels.

With this exception, the whole of the sewage is distributed, by two irrigators constantly employed by the town, on private lands when the occupiers require it, and, at other times, on such parts of the corporation land as they consider best, with a view to sewage purification. Submitting to these conditions, cowkeepers in the neighbourhood have annually tendered for the land at prices varying from £6 to £9 an acre. It is now let for three years at £800 a year, or a little over £6 an acre, to a tenant who sub-lets it to several smaller occupiers. Each field receives from three to five dressings a year, but it is said that in a dry summer the occupiers would be glad of two or three extra ones. Mr. Woodward, who hires the whole farm, considers that "sewage pays best on poor, hilly, heavy grass land, as it makes one acre worth five." The following is a balance sheet referring to the sewage farm and liquid sewage, from which it will be seen that the receipts are nearly enough to repay the cost of outfall works as well as that of purifying the sewage. The straining is carried on at the tanks, and the solid matter is mixed with town ashes and sold to farmers at 2*s.* 6*d.* a cube yard. If the ashes be regarded as valueless refuse, an average profit of over £50 appears to result from this part of the business.

1871.

| RECEIPTS. | £ | *s.* | *d.* |
|---|---|---|---|
| Rents . . . . . | 899 | 12 | 0 |
| Fluid Sewage on adjacent Lands . . . . | 75 | 10 | 0 |
| Deficiency . . . . | 134 | 15 | 0 |
| | £1,109 | 17 | 0 |

| PAYMENTS. | £ | *s.* | *d.* |
|---|---|---|---|
| Wages, Tradesmen's Bills, and other Expenses . . . . | 286 | 2 | 11 |
| Rates and Taxes . . | 26 | 19 | 8 |
| Interest on Loan for Land and Works . | 796 | 14 | 5 |
| | £1,109 | 17 | 0 |

## 1872.

| | £ | s. | d. | | £ | s. | d. |
|---|---|---|---|---|---|---|---|
| Rents | 868 | 15 | 10 | Wages, Tradesmen's Bills, and other Expenses | 280 | 15 | 5 |
| Fluid Sewage on adjacent Lands | 142 | 0 | 0 | Rates and Taxes | 27 | 14 | 10 |
| Deficiency | 80 | 11 | 5 | Interest on Loan for Land and Works | 782 | 17 | 0 |
| | £1,091 | 7 | 3 | | £1,091 | 7 | 3 |

## 1873.

| | £ | s. | d. | | £ | s. | d. |
|---|---|---|---|---|---|---|---|
| Rents, &c. | 936 | 19 | 6 | Wages, Tradesmen's Bills, and other Expenses | 286 | 7 | 0 |
| Fluid Sewage on adjacent Lands | 131 | 10 | 0 | Rates and Taxes | 52 | 2 | 11 |
| Deficiency | 38 | 7 | 5 | Interest on Loan for Land and Works | 768 | 7 | 0 |
| | £1,106 | 16 | 11 | | £1,106 | 16 | 11 |

## 1874.

| | £ | s. | d. | | £ | s. | d. |
|---|---|---|---|---|---|---|---|
| Rents, &c. | 848 | 14 | 9 | Wages, Tradesmen's Bills, and other Expenses | 253 | 3 | 4 |
| Fluid Sewage on adjacent Lands | 86 | 12 | 6 | Rates and Taxes | 47 | 4 | 0 |
| Deficiency | 118 | 4 | 1 | Interest on Loan for Lands and Works | 753 | 4 | 0 |
| | £1,053 | 11 | 4 | | £1,053 | 11 | 4 |

## 1875.

| | £ | s. | d. | | £ | s. | d. |
|---|---|---|---|---|---|---|---|
| Rents, &c. | 890 | 8 | 5 | Wages, Tradesmen's Bills, and other Expenses | 396 | 5 | 4 |
| Fluid Sewage on adjacent Lands | 145 | 18 | 0 | Rates and Taxes | 31 | 4 | 9 |
| Deficiency | 128 | 11 | 0 | Interest on Loan for Land and Works | 737 | 7 | 4 |
| | £1,164 | 17 | 5 | | £1,164 | 17 | 5 |

1876.

| | £ | s. | d. | | £ | s. | d. |
|---|---|---|---|---|---|---|---|
| Rents . . . . . | 853 | 6 | 6 | Wages, Tradesmen's Bills, and other Expenses . . . . | 268 | 1 | 10 |
| Fluid Sewage or adjacent Lands . . . . | 130 | 5 | 6 | Rates and Taxes . . | 50 | 8 | 3 |
| Deficiency . . . . | 55 | 14 | 7 | Interest on Loan for Land and Works . | 720 | 16 | 6 |
| | £1,039 | 6 | 7 | | £1,039 | 6 | 7 |

At *Chorley*, in Lancashire, the sewage is conveyed to two farms (principally arable), the one laid out at a cost of £20 an acre and worked by the Improvement Commissioners, the other being provided with simple spade-made grips contouring the ground. The latter is let to a tenant under a yearly agreement, at a rent beyond what the board has to pay; while the farm in the board's own hands cannot be made to pay its working expenses, exclusive of rent.

At Cleator Moor, in Cumberland, the sewage from 1,373 houses, or about 8,000 people, is removed from the town by means of four outfalls, discharging on to some forty acres of heavy pasture lands in the occupation of private people.

The present system has been in operation about three years; but the local board has no agreement either with the owners or occupiers of the land under sewage. In two cases, the land is farmed by the owners; but in each case the sewage is taken by the occupier for the sake of its agricultural value alone. The grass crops have been very much improved by the sewage; and one farmer has just bought a steam engine, and is laying down iron pipes, with a view to sewaging some of his land which is too high to be irrigated by gravity alone. Irrigation and grazing have been carried on together with no mischievous result.

The greater part of the solid matter is extracted by means of settling ponds; it is then mixed with town ashes,

and taken away by farmers. The board have had no trouble by reason of river pollution; but, unfortunately, provision was not made in the town for the exclusion of surface water from the sewers, and, on the occurrence of storms or heavy rains, it is found that the volume of water becomes rather difficult to deal with, as it makes a disturbance in the settling ponds, and carries over the suspended matter, besides polluting the watercourse to a certain extent.

The local board has only spent £500 on outfall works, including damage to property during their construction, and the working expenses which the board pay, in connection with the settling ponds, amount to about £2 a year.

At Cockermouth, a thoroughly water-closeted town, with a population of 5,115, 16 acres of low-lying but gravelly grazing land were hired by the local board some two years ago, on lease for 21 years, with power to sub-let, subject to the tenant previously in occupation having the refusal.

It does not appear what the board has to pay for the land, but the original tenant continues to occupy it, and pays a pound an acre more than he gave the owner, binding himself to receive the whole of the sewage, and keep it out of the River Derwent, by which the field is skirted on one side. This land is irrigated and grazed at the same time, and cattle have been frequently seen drinking the sewage in preference to the river water. The sewage passes through tanks, from which the sludge is pumped by hand. This, when dry, is sold at 2*s.* 6*d.* a cubic yard, a price which produces a profit upon the labour.

The field was nearly level, so that the surface was scarcely altered. The carriers were made entirely with spade and plough, at a very trifling cost; and there are no working expenses paid out of the rates. No provision has been made in the town to keep surface or subsoil water out of the sewers; but it is considered that it would be better if

there were, for a large quantity of subsoil water percolates into the main sewer, which is of brick, and, together with the surface water, adds to the risk and difficulty in times of sudden thunderstorms, when a very little neglect on the part of the tenant might cause the sewage to run over the land, straight into the river.

At *Crediton*, in Devonshire, the sewage of about 4,000 people, generally provided with water-closets, has for many years been used on grass land just outside the town. It is now let for seven, ten, or fourteen years, to three land-owners, who pay together £40 a year for the privilege of using it upon some 60 acres of meadow land. About 25 acres are let annually by auction, and have realized £8 and £10 an acre. The auction this spring, which was not so satisfactory,—owing, it is said, to a general abundance of feed in the neighbourhood,—resulted in an average price of about £7. A considerable amount of spring water joins the sewage before it reaches the land.

The carriers are simple grips contouring the ground; the soil is heavy and red. No solid matter is extracted from the sewage before it is applied to the land. Beyond the cost of sewering the streets, the sewage disposal involves no expense to the rates. During "most of the summer" it is considered that the meadows do not require the sewage, and it is not then used.

Denbigh, with a population of 5,823, is now being sewered, the "separate system" being in some measure adopted, as an old rubble drain, which discharges straight into a brook, is left to carry away surface and subsoil water. The use of the sewage has been let at £110 a year (£100, however, being allowed to the tenant out of the first two years' rent) for 30 years to Mr. Hughes, of Kinmel, who has 250 acres of mixed soil at a suitable altitude for irrigation without pumping. Simple tanks are to be provided for the

separation of suspended matters, when necessary. The nearest houses to the land which is to be sewaged are at a distance of about a furlong.

At Devizes the sewage of some 7,000 people has, for the last ten years, been discharged into an ancient watercourse, which from time immemorial has been diverted on to pasture lands a quarter of a mile below the town. The soil of these meadows is light, and they are said to command high rents.

There is no charge upon the rates for working expenses in connection with the disposal of the sewage, and the town, which has water-closets almost throughout, is considered, by those in a position to judge, to be satisfactorily free of the sewage difficulty. It appears, however, that at haymaking time, and just before it, the sewage is sometimes not dealt with at all.

At *Doncaster* the sewage of about 20,000 people has for the last five years been pumped on to a farm the property of the corporation. This farm, which consists of 263 acres of light, gravelly land worth, without sewage, from 15*s.* to 40*s.* an acre, is let on a 14 years' lease at a rent of £800, or rather more than £3 an acre. The surface of the ground was but slightly altered. The sewage is delivered on to the various high points in the farm by means of iron and earthenware pipes, either laid at a sufficient depth below the surface to be out of the way of the plough, or else under the fence along the headland, and then distributed by contour grips simply ploughed or dug in the ground. Nine-tenths of the farm is arable; about 40 acres of this are devoted to Italian rye-grass, and six or seven to market garden stuff, such as rhubarb, strawberries, gooseberries, currants, and cabbage, cauliflower, &c. Rye-grass is always cut four times a year here, and in some seasons might be cut a fifth time. Mangold do well, and keep as well as mangold grown in the ordinary way. They were being used on the 16th of

last April. A large storage reservoir was provided, when the farm was laid out, for use when for any reason it might be thought undesirable to put the sewage on the land; but this has been abandoned upwards of three years, and the sewage is now sent on to the land at all seasons with as little delay as possible.

*Edinburgh*, probably, from an agricultural point of view, affords the most remarkable instance of sewage utilization that is to be found anywhere, although the supply of sewage is, owing to the city being so close to the sea, far in excess of the requirements of the limited area of agricultural land in its immediate neighbourhood.*

The sewage of certain districts of Edinburgh has long been used in rough and rude irrigation, in some cases since 1760, the lands irrigated being known as the Craigentinny Meadows, which have an area of about 220 acres, "Lochend" Meadows, about 28 acres, "Lochryn-on-Dalry" Meadows, about 40 acres, and "Brigend" and "Cairn Tows" Meadows, about 35 acres, making a total of 323 acres. There are about 250 acres of the Craigentinny and Lochend Meadows under sewage irrigation; of these 200 acres are permanent pasture grasses, and 50 acres Italian rye-grass. About 2,500,000 gallons of crude sewage, every twenty-four hours, flows through the "Foul Burn" on to the meadows. The grass is sold by public roup at the beginning of April in each year, in allotments of from half a statute acre to one acre in area, at prices varying from £20 to £40 per acre, per annum; one allotment (acre) sold last year for £44 15*s*. The permanent grass is used for cow feeding, and is bought by dairymen, at Musselburgh, Portobello, Leith, and Edinburgh, who have to cut and remove it. This is done about four times in the season, and yields

* Local Government Blue Book, 1876—Sewage Disposal.

an aggregate crop of about 40 tons to the acre. The Italian rye-grass is cut five times a year, and produces occasionally 60 tons to the acre. The irrigation is carried on in the cheapest and rudest way by the owners of the land adjoining the streams of sewage, no cost having been incurred in providing permanent carriers of either wood, iron, stoneware, or brickwork. A considerable portion of the sewage is absorbed by the "sea sand" of which the irrigated meadows of Craigentinny Farm is composed, and thus the soakage of sewage from this land into the "Firth of Forth" is only partially purified.

The annual cost of applying the sewage and receipts for the produce are:—

| Receipts. | £ | Expenditure. | £ |
|---|---|---|---|
| 250 Statute Acres of grass, at an average of £30 per acre . . . . . | 7,500 | Wages of Watermen, three in summer and one in winter, and cost of cleaning out carriers . . . | 180 |
| | | Estimated Rent of Land, 250 acres at £2 per annum* . . . . . | 500 |
| | | Balance . . . . . | 6,820 |
| | £7,500 | | £7,500 |

About eight acres of the Craigentinny Farm, which is land of excellent natural quality, but too high to be irrigated by gravity, has had sewage pumped on to it by steam power. This land has received about 3,000 tons of sewage per acre, in six or eight dressings, during the year; and the rye-grass growing on it has realized from £25 to £36 an acre, prices equal to those obtained at "Lochend," where four times the quantity of sewage has been applied.

* First Report of Rivers Pollution Commissioners (Mersey and Ribble Basin).

At Guisborough (Yorkshire), in 1871, the local authority, having been threatened with litigation, entered into an agreement with Admiral CHALONER, who owns considerable property in the immediate neighbourhood, to deliver on to land of his, about 800 yards from the town, the whole sewage, for a term of twenty-one years commencing on the 1st of January, 1872.

Admiral CHALONER was to do all the work within the limits of his own land, and pay to the local board a rent of £5 a year for the sewage, with all liabilities. About 21½ acres of old grass land, part of which had been very good and part a complete bog, were prepared for sewage at a cost of £1,556. This work included thorough deep drainage, a considerable amount of levelling, laying carriers, and making new roads, besides building a cottage for the man in charge.

Here the sewage of about 6,000 people, to whom water-closets are only now being introduced, is distributed over the land in the condition in which it leaves the sewers, without separation or deodorization of any sort.

Italian rye-grass, it is said, certainly pays best. The average price per acre received for rye-grass was, in 1872, £10 7*s.* 2*d.*; in 1873, £15 5*s.* 2*d.*; in 1874, £24 18*s.* 11*d.*; in 1875, £26; and in 1876, which was a very unfavourable year for selling cut grass, only £17 18*s.* Last summer and autumn were both wet and cold, and only three cuttings were obtained, which realized together an average of £12 11*s.* 3*d.* an acre. Mangold, turnips, and carrots have been found to answer best as root crops, and rhubarb has paid very well, but that can only be sold in small quantities at Guisborough.

A profit and loss account has been kept since the farm was started, and after allowing £2 an acre for rent, and five per cent. upon the £1,556, besides paying all expenses, the following balances appear:—

| | £ | s. | d. |
|---|---|---|---|
| For 1872, a loss of . . | 47 | 3 | 5 |
| „ 1873, a profit of . . | 45 | 3 | 2 |
| „ 1874, „ . . | 163 | 0 | 10 |
| „ 1875, „ . . | 140 | 10 | 11 |
| „ 1876, „ . . | 50 | 6 | 3 |
| | £399 | 1 | 2 |
| Less . . . | 47 | 3 | 5 |
| | £351 | 17 | 9 |
| This gives an average profit of | £70 | 7 | 6 |

Or enough to pay an additional 4½ per cent. on the capital sunk, making altogether 9½ per cent. Last year, owing to the unfavourable season, barely 5 per cent. was realized upon the outlay. Notwithstanding the unsatisfactory sale of rye-grass during the last two years, the plant, Admiral Chaloner considers, improves year by year, which convinces him that the land has permanently benefited by the application of sewage. The soil, generally, is heavy, but loamy. Admiral Chaloner believes that a large quantity of water, which bothers him considerably in times of extreme wet, might be easily diverted from the sewers. This, evidently, was not considered to be an object when the sewers were constructed; but it appears that the importance of keeping as much surface water as possible out of the sewage is now recognized by the local authority, who are likely to carry out some inexpensive alteration in the town sewers for the relief of the sewage farm.

At Handsworth, near Sheffield, the sewage of one outfall, which serves a population of about a thousand, has for the last 14 years been used by the occupier of some land through which the outfall sewer passes. He applies it to grass land,

and also very considerably to rhubarb, during the winter months. The sewage has occasionally been intercepted by another occupier of land higher up the sewer. This has been very much to the annoyance of the gentleman who first took it, and who is said to consider that long usage, or some other circumstance, has given him a kind of ownership in the liquid.

No money has been spent in levelling the land, which is of a moderately stiff character. The sewage is spread over the land by means of grips cut in the ground and wooden spouting. In this way it covers an area of some 12 acres. Grazing and irrigation go on together in the same field, when convenient.

Hoddesdon, a village of 2,000 inhabitants, in Hertfordshire, has been lately sewered by the rural sanitary authority, and about 17 acres of gravelly land, almost devoid of soil, were taken, on a 21 years' lease, from the Marquis of Salisbury, for the disposal of the sewage.

The surface of the ground, which has a considerable natural slope in one direction, has been but little altered. It has, however, been provided with an earthenware carrier along its upper edge, a covered settling tank, capable of being completely emptied on to the lower part of the land, only, and a wooden building, consisting of stable, cart-house, and labourers' rooms.

At Michaelmas, 1876, a tenant was found for this sewage land, who occupies a considerable acreage of market garden ground in the neighbourhood, and supplies the London markets. He has been granted a 14 years' lease at a rent of £4 an acre, and now after a year and-a-half's trial appears to be well satisfied with his prospects. In March last, he was cutting sewage-grown brocoli which he considered "pictures," "more like cauliflowers than brocoli." He is also growing cabbages, beans, and other vegetables.

Surface water is kept out of the sewers to a considerable extent, but the tenant would prefer to have had this done more completely.

The tank is no longer used for the retention of solid matter, the sewage being allowed to run on the land as it comes from the sewer. The land is close to Rye House Railway Station and several cottages. Its rent, without sewage, had been 22*s.* 6*d.* an acre, which amount is believed to be all that is paid for some of the adjoining land.

*Leamington*, with 22,000 inhabitants, has been as fortunate as Denbigh in being able to sell its sewage for agricultural purposes; but, unhappily, Lord Warwick, who undertook, in 1871, to pay £450 a year for the sewage for thirty years, requires it to be delivered on to a farm of his, called Heathcote Farm, which is at a distance of two miles from, and at an altitude 130 feet greater than, the old sewer outfall into the river. Previously to the agreement with Lord Warwick, the corporation had spent £8,000 in precipitation works (which have since been abandoned), £5,000 in defending a Chancery suit, and £1,500 in cleaning out the River Leam, in consequence of an injunction in Chancery. The new pumping station, rising main, &c., including all necessary works up to the point of delivery at the summit of the farm, cost £16,239, and the working expenses of the pumping establishment amount to £1,035 a year; so, if the capital be borrowed at 3½ per cent., the cost of sending the sewage to Lord Warwick's farm would be, £568 interest on loan, *plus* £1,035, or £1,603, a year. This annual payment may be regarded as almost entirely due to the unfortunate fact that Lord Warwick's land happened to be above the town instead of just below it. What has to be dealt with in this Paper, however, is principally the question of whether sewage can be advantageously used by farmers when they have it delivered at a

suitable altitude. Only such facts, therefore, as have a bearing upon that question will here be referred to.

Heathcote Farm contains about 310 acres, which are irrigated. The soil is mainly loam over gravel or marl, but about a fourth part is clay; the whole being "rather of a second quality as regards natural fertility." *

Although the rain-water falling on some of the streets is excluded from the sewers, they receive all that is collected by roofs of houses and yards. In very wet weather more water reaches the pumping station than can be dealt with by the pumps or the reservoir (which is of sufficient capacity for the sewage of a night or a dry Sunday), and an overflow occurs into the Leam.

The cost of pumping unnecessary or useless water, and the desirability of water supplying a river having to pass through sewers and sewage tanks, will not be discussed here; but Captain Fosbery, Lord Warwick's agent, who has had the general management of the farm ever since, and even before it was sewaged, says it is most certainly desirable, from his point of view, that provision should be made for the further exclusion of surface-water from the sewers, although in dry seasons any supply from which the summer flow of sewage might be increased would be of the greatest service to the occupier of the land.

The quantity of sewage pumped daily on to the farm varies from 800,000 to 1,000,000 gallons. It is, therefore, rather dilute, and by the process of pumping made more even in quality and appearance than might otherwise be the case. It is, however, delivered on to the land as it reaches the pumping station, thick and thin together, with the exception of such chance materials as may be kept back for the safety of the pumps.

* Chalmers Morton.

The land was laid out under Captain FOSBERY's supervision, at a cost of about £7 an acre, including drainage to a depth of 4 or 5 feet. The surface was altered but very little; the position of the carrier, and even the number of carriers, by which the sewage is introduced to the field, having been, it seems, governed by the natural lie of the land —a plan preferable to the too common practice of paring down the surface and robbing it of soil till it can be irrigated from channels drawn with a parallel ruler.

From the accompanying table it will be seen that this farm has been worked with a view to producing milk, meat, and grain.

With reference to the former, Lord WARWICK has a satisfactory contract with a milkman in Leamington, under which his lordship supplies him with the produce of fifty good dairy shorthorns:

"Four men are daily engaged in distributing the sewage, generally at as many different points upon the farm, according to the needs of the crop, or of the land, or the power of the soil on different fields, to deal with it at such times, as it is not wanted for the promotion of current growth. These four men are, however, available for other work during a great part of their time. During spring and summer they are employed in cutting grass for purchasers, who bring their carts for its removal, paying from 8*d*. to a shilling a rod for the grass as it is cut. They receive 17*s*. a week, besides 1*s*. an acre for the grass they cut, and can generally make about 21*s*. a week during the year. The water is in autumn and winter roughly directed by plough and spade-made furrows over the stubbles and the fallow intended for next year's beans, oats, barley, and mangold-wurzel. In spring and summer, the Italian rye-grass takes most of it, but mangolds, cabbages, and various garden crops are watered as they want it"; root crops, however, with the exception of cabbages,

Mr. Tough, Lord Warwick's bailiff, says, never have sewage applied to them before May or June.

Immense crops of mangold are grown; the yield of 1874, in two large fields, is said to have been in several places where the weight was taken over half a ton to the rod.

As many as ten silver cups have been won by roots grown on this farm with sewage, besides a number of money prizes.

The sewage, when not required upon the Heathcote Farm, is supplied in considerable quantities (as will be seen from the table) to six of Lord Warwick's tenants who occupy adjoining farms, and who, together, have irrigated over 200 acres of their own holdings. In each of these cases Lord Warwick has constructed the works necessary to deliver the sewage on to the nearest point of the farm, and the tenant has made the carriers necessary for distribution. These generally consist of grips cut in the ground or built up above it with turf, and are of a very inexpensive character.

Sewage is used by the tenants upon grass and arable land. The receipts from this source amounted to £46 in 1875, and to £60 in 1877.

There are a number of cottages on the sewage farm, and the families have been singularly free from any illness.

Captain Fosbery is able to state that, notwithstanding the £450 a year with which the concern is unfortunately debited, the returns have been sufficient to pay a very good interest on the capital expended, after deducting rent and all working expenses

At Leek, in Staffordshire, the sewage of some 12,000 inhabitants, about a third of whom are provided with water-closets connected with the sewers, is carried out of the town by two outfalls, which discharge on to grass lands belonging to private gentlemen The sewers were constructed in their

present position on condition that certain owners should make what use they pleased of the sewage, without any liability for river pollution through neglecting to use it. This appears a one-sided arrangement, but it has been found to act very well for upwards of fifteen years; for the sewage from the southern outfall, which is rather more than half, is used over some 60 acres of sloping grass land of a generally light character in the occupation of several different farmers, who would be glad to increase the area under irrigation, if more sewage were available. The northern outfall discharges on to some low flat alluvial meadows, about 70 acres of which absorb all the sewage that comes to them during nearly the whole year. There are, however, six weeks or two months at hay-time, when it is found more convenient to let the sewage of the northern outfall flow away without passsing over the land.

This town may be said to be bounded on two sides by sewage fields; yet some very elaborate returns which have been most carefully and ably kept by the sanitary inspector for many years, show that its sanitary condition has been very much improved by the works that remove the refuse of the town from beneath the ground on which it stands to the surface of that immediately adjoining it, while it is a well-known fact that one field which is sewaged at Leek, is let at £7 10*s.* an acre, and the adjoining one, not sewaged, at £3 15*s.*

The sewage of Leek is disposed of so as to keep the town in a healthy condition and free from litigation, and to keep some of the agricultural parishioners supplied with an article they are glad to make use of, without any expense to the ratepayers. No money has been spent upon levelling the land, and, with one very slight exception, the surface carriers are merely plough and spade made channels.

Longton affords an example of how a landowner may,

with due consideration for his own interests, offer more satisfactory terms to a local authority for its sewage disposal than the authority can obtain by other means. This borough has a population of about 20,000, and is one of that closely-packed group of pottery towns, the greater number of which are still in the utmost doubt and difficulty in reference to sewage matters. It has, however, been fortunate enough to secure an arrangement with the Duke of SUTHERLAND under which his Grace has constructed 1,256 yards of outfall sewer and undertaken on being paid £500 annually to deal with the sewage of the borough and all its liabilities for a term of twenty-one years. The Duke had had some experience of sewage farming, for at the very spot where the new outfall sewer leaves the public street is a greengrocer's shop with about twelve acres of market garden behind it, on which the sewage of the adjoining districts of Dresden and Florence (containing together five or six thousand people) has been used for four years. The market gardener pays his Grace a very high market-garden rent for these twelve acres, and supplies the town from them with rye-grass and vegetables.

The new main sewer intercepts the sewage of Florence and Dresden, as well as that of Longton, and is made to supply the market garden, which it passes through on its way to the larger farm which is now being laid out. About 120 acres are already under sewage, and let to the market gardener above referred to; but many hundred acres of the Duke's land is favourably situated for the reception of the sewage, and much of this, it is said, will be gradually brought under sewage cultivation. Beyond the grubbing of hedges, the surface of the land has scarcely been altered. The soil is stiff, and the tenant considers that the "separate system" of sewers, which has been adopted in Longton, is very desirable. Rye-grass can be cut only four times a year, but

there is a good market for it in the town, and it is found very profitable.

At Mansfield, where there are about 12,000 inhabitants and 300 water-closets, the sewage of the whole town goes straight into the River Maun, which more than forty years ago was diverted at a point just below the town by the late Duke of Portland into a cut called the "Flood Dyke," made for the purpose of irrigating his now celebrated Clipstone Meadows.

These meadows comprize an area of upwards of 300 acres of land, extending over a distance of about seven miles in length. They are watered by the river Maun as it flows eastward from the town of Mansfield. The value of the land has been raised from the annual sum of £80 to that of £3,660, at a cost (from their commencement in 1816 to their completion in 1837) of £40,000. The profit of each acre after defraying all expenses has been computed at nearly £12 a year, without taking into consideration the great benefit they are to the arable land adjoining them.

In February last, the Flood Dyke, a canal some 20 feet wide, was carrying a sluggish flow of dirty black water which it discharged at intervals on to dark green sloping meadows, at the foot of which, in the bed of the old river, ran a stream of tail water sufficiently clear for fish and stones to be easily counted at the bottom.

The Duke's steward, Mr. Henry Wood, has kindly reported, for the purposes of this Paper, that there is no season of the year at which the water cannot with advantage be turned on to the meadows, and that the steeper the ground the better is the quality of the grass produced.

To some it will no doubt occur that since the Clipstone Meadows have been in successful operation for forty years, and the town of Mansfield has not been sewered half that

time, their great value is not mainly due to the manure they receive from the refuse of that town. This is not, however, a sound deduction, for the greater part of the soluble matter wasted in a town must reach the river that drains it. If there are no sewers, it will follow the course of the surplus rainfall, either over the surface or through the ground. In this case the river would be spared some of the putrescible organic matter due to sewers, but the bulk of the nitrogen would find its way to the river as nitrates and nitrites—forms very suitable to vegetation.

At Ormskirk, in Lancashire, a town with 6,000 inhabitants, and a considerable number of water-closets, the local board, after four years' experience of sewage farming, succeeded, about four years ago, in letting their farm to a working farmer at a rent, it is said, of £100 a year more than they give for it under a ninety-nine years' lease. The farm consists of 68 acres of black peaty soil, overlying the clay, which the occupier considers comes a great deal too near the surface. Only 40 acres, all of which are arable, are at a suitable altitude for irrigation; and in summer-time, when the land is pretty well covered, difficulty is found in providing a place for the reception of sewage. Rye-grass, potatoes, and market-garden stuff are grown, rhubarb being noticeable as a crop that evidently does well. The solid matter is settled in tanks at the upper edge of the farm, and mixed with town ashes, for use on land. The surface of the ground has been scarcely altered. The sewage, on leaving the tanks, is carried along either of the two sides of the farm by means of a pipe channel raised on a bank of earth, and from these it is distributed over the land by means of simple grips cut temporarily in the ground. The rye-grass is cut for hay twice in the season, and for sale or home use as required.

At Penrith, the sewage of some 7,000 people was dis-

charged into the River Eamont. Till some ten years ago the outfall was objected to, as a nuisance, by the owner of the property in which it was situated, who occupied a mansion within a few hundred yards of it. Law proceedings were talked about, but were averted by the complainant having conceded to him the right to use the sewage for his own purposes and profit. The co-operation was secured of Mr. McDougall, who had already used the Carlisle sewage for some years. This gentleman took some 70 or 80 acres of gravelly grass land close to the river, on a lease, with the rights in the sewage which had been granted away by the local board. On to this land, at his own expense, he diverted the whole sewage, by means of a sewer nearly half a mile long; and, as lately as last month, the sewage was seen running thick and thin on to the grass, amid a herd of 120 beasts. There is a very pretty arrangement here for adding some disinfecting mixture (patented by Mr. McDougall) to the sewage; but this is only used during very hot weather, and then not continuously. The ground is very uneven, and the sewage is conveyed by means of earthenware channel-pipes, laid permanently along the higher parts of the field; from these it is distributed by portable spouting of wood and iron. No advantage is apparent in these carriers corresponding to the trouble and expense they involve. The unevenness of the ground, however, has not interfered with the purification of the sewage, which was reported by the Rivers Pollution Commissioners to have been satisfactory.

At Plympton St. Mary, near Plymouth, the sewage of over 3,000 people is given to Lord Morley, who for the last five years has distributed it over some 100 acres of porous sandy meadow land. Lord Morley employs a man whose duty it is to attend to the irrigation; but the land is in the occupation of eight different tenants, who, to

use the words of the irrigator, are "crazy after the sewage," excepting during some two or three months in the summer, and then the sewage is run straight into the tideway without any cleansing beyond what is affected by settlement in some tanks through which it passes all the year round, and which are emptied of deposit once a year. His lordship does not allow a field to be irrigated that has cattle in it, as his agent is of opinion that this would lead to the land being trampled into holes. It appears probable that the sewage would otherwise be used more in the summer months than it has been.

The schools and the church are within 100 yards, and a number of villas within 200 yards, of the outfall.

The surface works are mere contour grips cut in the ground, and these, together with under drainage and outfall sewer, appear, from the well-known Rochdale Returns, to have cost Lord Morley £1,000.

Mr. Newbury, his lordship's agent, says the undertaking has been most successful, the land being improved twofold by the sewage.

Rugby has contributed, probably, more to the national stock of sewage-utilization facts than any other place except Edinburgh, for as early as 1865 the Highland and Agricultural Society of Scotland awarded a premium of thirty sovereigns to J. A. Campbell, Esq., for a report of his on "The Application of Sewage," which was based upon his own experience, during eleven years, of the use of a portion of the sewage of the town of Rugby. During those eleven years, Mr. Campbell irrigated about 190 acres of land, laid out with 3-inch iron pipes, through which the sewage was pumped by a 12 H.-P. steam engine.

The early experience at Rugby led Mr. Campbell to report as follows :—

"Although I fully appreciate the value of sewage for

certain descriptions of crop, and under certain conditions, I do not think I should be justified in recommending it for general adaptation to the usual routine of the farm. It seems pretty evident to me that the expense and trouble of applying it by means of pipes to arable ground would not be compensated by the increase of the crop; nor could it be applied with regularity on account of the variable nature of the climate. To the dairy farmer, for the purpose of obtaining heavy crops of green forage, it will be always useful, and by its application to grass lands it may be made of essential benefit to the community."

This is merely quoted to show that the author of it, who will be again referred to, is not an enthusiast upon the subject, but a gentleman likely to consider the question from a practical point of view.

Rugby has a population of about 9,000, and water-closets are adopted throughout the town. Eight years ago the local board leased a farm of 65 acres for thirty years at a rent of £265, the board paying tithes. On to this the sewage runs without pumping.

Until 1874, the farm was worked by the local board, who lost money by it. Since then, however, it has been let under a yearly agreement, for £350 a year, to Mr. Campbell, who had previously rented the same land for ordinary cultivation at £3 an acre. The board employs a man, at a pound a week, whose duty it is to properly distribute the sewage. The distribution is no longer effected by means of expensive iron pipes, as it has been, but with open channels cut in the ground. The soil is a gravelly loam overlying the blue lias clay. Mr. Campbell kindly reports, for the purposes of this Paper, as follows:—"Italian rye-grass answers best; but I have good crops of wheat, oats, mangold-wurzel, and turnips. The grain crops give a large amount of straw, which is now

very valuable, and consequently they sell well by auction as the straw goes off."

The rye-grass here is cut five times a year, and sold at from 10*s.* to 20*s.* a ton. The coarser particles of solid matter are arrested in screening-tanks before the sewage is allowed to flow on to the land. Where new sewers are constructed in the town, provision is made for the exclusion of surface-water; and this Mr. CAMPBELL's experience has made him consider desirable.

For the utilization of the sewage of another portion of the Rugby district, about thirteen acres of arable land have been hired from the rector at a yearly rental of £54, and sublet at £79 a year, at which rent it continues to be held.

Ruthin, in North Wales, was drained some seven or eight years ago by Mr. MARTIN, C.E., of Exeter, and the sewage of about 3,000 people was conveyed by two outfall sewers on to meadows immediately adjoining the town. These meadows (112 acres in all) were taken on a twenty-five years' lease by Mr. MARTIN, who, together with his landlord, has leased the sewage from the town council for the same period at a rent of £20 a year.

Two-thirds of the town are provided with water-closets, and a considerable amount of spring water finds its way with the sewage on to the land. No solid matters are extracted. A man, a lad, and a donkey are employed to direct the sewage and attend to the garden and the carriers. These are merely contour grips cut in the ground. Only about £250 was spent in the preparation of the surface, which is by no means even; but the land, a large part of which had originally been a morass, was already drained and fit for profitable agricultural occupation.

The whole of the land is let annually by tender in eight or ten lots, the persons taking them being at liberty to

cut and use the grass as they please from the middle of April to the end of November.

In 1875, the 112 acres produced £521 5*s.*; in 1876, £514 11*s.* 5*d.*; and in 1877, £557 18*s.* In 1875, 4½ acres of young grass were cut for the first time and were sold for £40; otherwise the increase of price would have been constant.

Since the end of last November, £50 has been taken for sheep feed. A quantity of the hay grown on these meadows last year was sold at £6 a ton.

Every year there are meadows which, not being mown, are available for sewage irrigation during the hay season; but an acre of garden ground is provided which receives the sewage when, for any temporary reason, it is not wanted on the grass. The garden stuff has produced upwards of £15 in the season. The soil varies from loam to clay and peat, all of which, except a small portion of the clay, rest on alluvial gravel. The London and North Western Railway Company's platform has only the width of their road between it and the principal outfall, and the centre of the town is not more than 300 or 400 yards from the meadows.

At Ruthin, Mr. Martin appears to have already brought into satisfactory operation a nearer approach than can elsewhere be found to the arrangement that the whole of these notes point to as the proper solution of the difficulty in a large class of cases.

The sewage of South Molton, in Devonshire, a thoroughly water-closeted borough with 3,000 inhabitants, is carried out of the town by means of three outfalls, and has for a number of years been let at rents varying from £6 to £10 per annum for use on old pasture land, about thirty acres of which have been irrigated by means of contour grips cut in the ground. Two of the outfalls were provided with

tanks for the interception of solid matter. These, in one case being very near the town, have been objected to as a nuisance, and the council have purchased sixty-eight acres of land about a mile off which will be prepared for irrigation and let with immediate possession. It appears from this that the corporation, having had considerable experience, are of opinion that farmers are able to deal with sewage satisfactorily from a sanitary as well as from an agricultural point of view.

At Swinton, a suburb of Manchester, having scarcely any water-closets, provision was made some seven years ago for the upward and downward filtration of the sewage of some 10,000 inhabitants. Some of the heavier particles may still be arrested in tanks, but the sewage now passes from them in a very dirty, black condition on to a 16-acre meadow of very stiff land, which evidently does very nearly all the purification that the sewage is subjected to. The meadow is divided, as meadows in stiff soils commonly are, into "lands," and for the purposes of the sewage a small grip has been dug out of the crest of each land. In the part of the field which was laid out first, these grips were lined with earthenware channel-pipes; but this process has not been continued in the part prepared more recently, the simple grip being found sufficient.

This meadow was first let by tender at £38 a year. It is now let for £72, or £4 10*s.* an acre, the tenant attending to the sewage, which produces for him three cuttings a year. Grazing is forbidden by the local board, lest the carriers should be injured. Storm water is kept out of the drains as far as practicable. The outfall sewer has also been tapped for the convenience of a farmer, who pays the local board £5 a year and uses the sewage when he pleases.

At Tavistock, with a population of about 7,000, two-thirds of which are supplied with water-closets, the sewage

has, for the last six years, been let at £50 per annum, under a yearly agreement, to the Duke of Bedford. It is used upon some 90 acres of meadow land in the occupation of two tenants, who undertake to utilize the sewage without annoyance to the neighbourhood or the river authority.

Tavistock has a very abundant water supply from the neighbouring hills, and the sewers collect a large quantity of subsoil water in addition, the result being that there is liquid enough to cover the ground three or four times each year. The meadows are let at about £5 an acre. The outfall is within a hundred yards of upwards of a hundred cottages, the inhabitants of which are reported to be in a satisfactory condition of health. The sewage used to pass through a tank, where the solid matter was, to some extent, arrested; but the process of emptying was so offensive that the tank was abandoned, and, in deference to the views of neighbours, the field in which it stood has not since been irrigated. This circumstance affords an important note upon the commercial side of the question, as well as from the sanitary point of view, for the tenant, Mr. Battams, who rents some 600 acres of grass land from the Duke, says that, owing to his ceasing to irrigate those ten acres, he has to give up fatting five beasts, which means a loss to him of about £25 a year. The soil is of a mixed character, being stiff over a considerable area, but the whole overlies an open gravel. The surface has been but very little altered, the carriers being spade-made, in contour lines. The greater part has been deeply drained with rough stone drains.

At Tyldesley, near Manchester, the sewage of 5,000 inhabitants, with scarcely any water-closets, is delivered, under an agreement terminable by either side at six months' notice, on to a farm almost a quarter of a mile from the town. The occupier, who has been in the same farm (a large one) for the last 40 years, has used the sewage during the last seven

on 40 or 50 acres of meadow land, which have been irrigated with brook water from time immemorial.

He is well acquainted with the subject of irrigation, and fully recognizes the value of sewage as manure, but considers that without the help of the brook it would be of little practical use, as the flow would be too small to cover any considerable area. He does not like to graze and irrigate land with sewage at the same time, lest his fields should be infected with disease from cattle slaughtered in the town, but he sees the importance from an economical point of view, of eating down the food as rapidly almost as it is produced. By doing this the fine quality of the herbage is maintained. Complaints have been made by the landlord of the farm (who is also interested in the lower part of the river), that river pollution has not been prevented by the measures at present adopted; and it has appeared probable that he would make the local authority comply with the Rivers Pollution Act independently of his co-operation. It has not, however, been established that the fouling of the river was due to any circumstance within the control of the farmer; and it is understood to be probable that, at the tenant's desire, the arrangement may continue as hitherto. No preparation has been made for the sewage, beyond what existed when the meadows were irrigated by the brook, excepting some wooden troughs which carry the sewage across the river, and which, from the marks of overflows on their sides, appear not to be large enough for their purpose. No provision has been made in this town for the exclusion of surface water from the sewers.

Waltham Abbey, with a population of 5,000, affords a remarkable instance of parochial unanimity upon the question of whether sewage is desirable or not to occupiers of land. Here the whole personal refuse is collected by means of very sound modern sewers at a point in the Town Mead only just

outside the town itself, where there are tanks and a steam pumping-engine. The tanks were constructed some seven years ago, with a view to the sewage being relieved of its suspended matters by precipitation with lime or some other chemical; but for the last four years they have only been used as storage reservoirs to hold the sewage on Sundays, or during parts of week-days when it is not found desirable to keep the pump at work. The surface and subsoil water of the town is kept out of the sewers as far as practicable, and the reservoir is found sufficient to make pumping unnecessary more than half the day.

For the last four years the solids have been roughly strained and settled from the sewage, and it has been pumped on to the surface of the ground for irrigating the Town Mead and some market-garden land adjoining. The mead is what is known as "Lammas land," on which every householder in the parish may graze as many horses, beasts, or sheep as he pleases between the 12th of August in one year and the 6th of April in the next. On the 6th of April it is shut up for hay, to be cut by the tenants, of whom there are about a dozen, each having a certain plot marked out by little low stumps permanently kept in the ground. Only one cutting is allowed, and the consequence is that when the cattle are turned on in August the grass is pretty nearly knee high.

Notwithstanding the complicated character of the ownership in the Town Mead, the whole sewage is pumped on to it (without injury, it may be presumed, to any one interested) from the middle of September till the beginning of May, when it is diverted on to the market garden.

The various owners of the mead take care that their own plots receive a fair share of the sewage, and the cattle, which have the free run of the whole, appear to be very fond of the sewage-grown grass, for it is said that they may be

seen nibbling it before the sewage has disappeared from the ground on which it grows. The market gardener say he finds it very useful with mangold-wurzel, brocoli, savoys, cabbage, and celery.

He has only used the sewage during the last two years, before which difficulty was found in disposing of it in June and July, while the mead had long grass or hay upon it.

The soil is light but peaty. No expense has been incurred in preparing the mead, beyond what was required to cut a grip along the higher edge. So much of the central part as cannot be irrigated from this is reached by means of portable wooden spouting. There are several houses within three or four hundred yards of the sewage ground, one being the residence of a magistrate, whose garden runs down to the mead. This gentleman had his attention called to the sewage, about two years ago, by an intolerable smell arising out of some neglect in the management of the tank; but since that he says he has experienced nothing to complain of.

At Ware, in Hertfordshire, the local board, in 1873, took a farm of 114 acres, with a good house and buildings, on a twenty-eight years' lease, at a rent of £460. This is considered to be about 30*s.* an acre more than could have been expected from a tenant-farmer. The board, however, since the sewage has been applied, has succeeded in subletting the Rye Farm, on a seven, fourteen, or twenty-one years' lease, at an enhanced rent of £483. The farm is situated in the parish of Stanstead, close to the celebrated Rye House, whose summer-house, known as the "Retainers' Hall," is only separated from irrigated rye-grass land by the boarding of which it is constructed. The farm-house itself stands almost in the centre of the sewage land, and the tenant, who also farms another large farm in the neighbourhood, only spends part of the year at the sewage

farm-house. When asked in March last whether he suffered any annoyance during his stay there, he answered, "Nothing beyond the increased appetite of my family." The Rye Farm appears not to be at such a level as would allow of the Ware sewage flowing on to it by gravity. The whole personal refuse of some 6,000 people, together with as little surface water as practicable, was therefore pumped through a rising main into a concrete reservoir at the summit of the farm, which, having naturally a hogsback tolerably regularly down its centre, is laid out with a wooden carrier along the ridge. The tank was used for settling the solids; but this process was found offensive when the tank was emptied, and has lately been abandoned, the sewage being poured on to the land as it leaves the sewers.

The soil is light, with gravel under it, and the sewage has, at present, been distributed over about 80 acres only. The tenant has no fears about sewage-grown mangold not keeping, as has sometimes been alleged, for owing to an oversight he has had some kept for over two years in a perfectly sound condition.

Wellington, in Shropshire, a town of about 6,000 inhabitants, where water-closets have not yet become general, is sewered into a small watercourse, of which so much as is within the town has been culverted. From this it is diverted on to meadows said to considerably exceed 100 acres in extent, and which cover some four miles of country between the town and the River Tern. The soil is principally light, and several owners enjoy the advantage of the sewage, but none of them have any agreement with the local authority, although an understanding exists among themselves, which insures each having his share. The sewage is disposed of at no cost to the rates. Heavy crops of grass are obtained, and those in a position to know consider that Wellington is satisfactorily free of the sewage difficulty.

Wellington, in Somersetshire, another town of 6,000 inhabitants, is also able to dispose of its sewage satisfactorily at no expense to the rates, beyond the original cost of constructing the sewers.

The sewage of this place has for many years been conveyed by three distinct outfall sewers on to different meadows, for the benefit of the occupiers. There are no water-closets in the town, but all the privies are connected with the sewers. No money has been spent in altering the surface of the ground. The carriers are simply grips cut with spade and plough. The soil is light; and the best proof that the sewage is of agricultural value is (in the words of the local board surveyor) "that the occupiers of the land through which it passes are very chary over it." No extraction of solid is attempted, excepting in summer-time, when tanks are used, and the sludge is taken out and dried for use with the drill. No provision is made for excluding surface water from the sewers, but the Surveyor's experience at Wellington has led him to consider that such provision is desirable.

At Wilsden, in Yorkshire, containing a population of over 3,000, the sewage of rather more than half the town has for the last thirty years been discharged on to meadows for the farmers' own benefit. Some 14 acres of nicely sloping land are irrigated, and this is said to be worth £30 or £40 a year more than it would be without the sewage. No money has been spent in levelling the ground. Where inequalities exist, the sewage is carried across the low ground in wooden spouting, and it is spread by means of grips cut with the plough.

Middens are in general use, but these are connected with the sewers. The sewage is probably, therefore, considerably decomposed before it reaches the land; and, although no attempt is made to extract any solid matter, these are

said to disappear very rapidly. There are houses divided from the sewage field by a high road only.

So much of the town as is drained on to this land is said to be satisfactorily rid of its refuse, and at no expense. The Local Government Board is urging the Board of Health to sewer the other and higher part of the town, and the owner of the land already under sewage is willing to receive the sewage of the whole town. He wishes, however, to have an agreement that surface and spring waters shall be kept out of the sewers, and, as the board object to this, nothing has yet been done in the matter.

At Wrexham, the corporation, in 1870, took a lease of a farm, containing about 84 acres, and became sewage farmers. In 1872, they determined to let the farm with the sewage of their 9,000 constituents, and were fortunate enough to secure as a tenant Lieut.-Col. Jones, V.C., whose name has become well known in connection with the sewage question.

Colonel Jones has written a very interesting pamphlet, entitled "Will a Sewage Farm Pay?"* which contains every detail as to the management, working, and accounts of this farm; so these need not be fully gone into here.

During the first three years of his sewage farming, Colonel Jones got together a dairy of 25 cows, the milk from which he sent twice a day into Wrexham. About three years ago, however, he handed his cows and dairy establishment over to an experienced milkman at a valuation, and has since continued to supply fodder for the cattle.

About 17 acres are generally laid down in rye-grass, which stands three years, and produces about 40 tons annually in seven or eight cuttings.

The remainder is devoted to wheat, mangold-wurzel,

* R. Potter, Publisher, Wrexham.

and potatoes, with the exception of about 5 acres, which are stocked with market-garden stuff.

The soil is light and the surface has been altered as little as possible, the carriers being made to contour the slopes. These, where practicable, are mere channels cut in the ground; but where extreme proximity to the stream, which must not be polluted, or steep gradients, render such inadmissible, the earthenware carriers are adopted. Colonel Jones has done all that can be done by writing to bring about a separation between the sewage and the surface water of Wrexham, and he is well known to have called attention to the advantages of the "separate system" generally. His representations, with this view, have resulted in provision being made for the exclusion of surface water from any extensions in the sewerage system which may be made from time to time. The solid matter, which is arrested in tanks before the sewage is allowed to pass on to the land, used to be carted on to a few acres of land which were at too high a level to be irrigated; but since the commencement of last year it has been dried by a process called Kidd's process, and mixed with sulphate of ammonia and bone meal, and sold, as "The Farmer's Friend," at £6 10*s.*, with advantage, it is said, to purchaser as well as to the manufacturer.

From the following balance sheets it will be seen that the last five years' working has produced favourable balances of £186 3*s.* 3*d.*, £276 4*s.* 6½*d.*, £271 18*s.* 6½*d.*, £392 19*s.* 0½*d.*, and £105 2*s.* 5*d.*, respectively. The first year alone resulting in a loss, which amounted to £81 18*s.* 6*d.* These appear, after £5 an acre is allowed for the 84 acres of corporation land, and £3 an acre for 20 acres since added to the farm, on account of rent, taxes, &c., besides 5 per cent. on all capital, together with another 5 per cent. on such as has been laid out on permanent works, such as levelling, carriers, roads, &c.

## BALANCE SHEET FOR YEAR ENDING FEBRUARY 2ND, 1874.

### DR.

| 1873. | | £ | s. | d. |
|---|---|---|---|---|
| Feb. 2nd. | To Capital . . . . | 1,043 | 7 | 4½ |
| Feb. & Mar. | „ Capital advanced by Col. Jones | 150 | 0 | 0 |
| July. | „ „ „ „ | 150 | 0 | 0 |
| 1874. | | | | |
| Feb. 1st. | „ Interest on above Capital, viz.: One Year at 5 per cent. on £1,193 7 4 = £59 13 4 | | | |
| „ | „ Half-year at 5 per cent. from July on £150 0 0 = 3 15 0 | | | |
| „ | „ Payment to Sinking Fund for permanent improvements, 5 per cent. on £334 18 5½ = 16 14 1 | | | |
| | | 80 | 2 | 5 |
| | „ Capital—One-half Year's Rent to date . . . | 170 | 12 | 6 |
| | „ „ Poor Rate . . | 17 | 0 | 0 |
| | „ „ Open Accounts . . | 51 | 10 | 9 |
| | „ „ Balance . . | 186 | 3 | 3 |
| | Total . . | £1,848 | 16 | 3½ |

### CR.

| 1874. | | £ | s. | d. |
|---|---|---|---|---|
| Feb 2nd. | By Cash in hand . . . . | 18 | 8 | 6 |
| „ | „ Valuation—Live Stock £741 0 0 | | | |
| „ | „ „ Dead Stock 688 9 4 | | | |
| | | 1,429 | 9 | 4 |
| „ | „ Improvement (at cost price) . | 334 | 18 | 5½ |
| „ | „ Profits on dealings with Agricultural and Horticultural Association . . . . . | 2 | 12 | 10 |
| „ | „ Open Accounts . . . | 63 | 7 | 2 |
| | Total . . | £1,848 | 16 | 3½ |

## BALANCE SHEET FOR THE YEAR ENDING FEBRUARY 2ND, 1875.

| Dr. | £ | s. | d. |
|---|---|---|---|
| To Balance of Sundries and Implement Account . | 32 | 4 | 0 |
| „ „ Rent and Taxes Account . . | 0 | 9 | 8 |
| „ „ Barley Crop (Couch Field) . . | 15 | 18 | 6 |
| „ „ 1873 Crops . . . . . | 3 | 17 | 3½ |
| „ Interest on Capital, viz.:— | | | |
| One Year at 5 per cent. on £1,830 = £91 10 0 | | | |
| Sinking Fund at £5 per cent. on | | | |
| £479 . . . . . = 23 19 0 | | | |
| ——— | 115 | 9 | 0 |
| Balance of Profit . . . . | 276 | 4 | 6½ |
| Total . | £444 | 3 | 0 |

| Cr. | Acres. | £ | s. | d. |
|---|---|---|---|---|
| By Balance, Italian Rye-grass Account . | 13 | 184 | 16 | 10½ |
| „ „ Mangolds Crop . . . | 5 | 46 | 8 | 10 |
| „ „ Filter Beds (Market Garden) . | 4 | 20 | 15 | 10½ |
| „ „ Permanent Pasture . . | 41 | 58 | 8 | 4 |
| „ „ Oat Crop . . . . | 2½ | 11 | 5 | 6 |
| „ „ Wheat Crop . . . | 6 | 56 | 10 | 11 |
| „ „ Potatoes . . . . | 2 | 2 | 6 | 4 |
| „ „ Carrots . . . . | 1½ | 0 | 17 | 9 |
| „ „ Tank Account (Solid Manure) | 1 | 17 | 17 | 0 |
| „ „ Barley Crop (Couch Field), from Dr. side . . . . | 6 | — | | |
| Total Acres . . | 82 | | | |
| By Balance, Dairy and Stock Account . | | 44 | 15 | 7 |
| Total . | | £444 | 3 | 0 |

BALANCE SHEET FOR THE YEAR ENDING FEBRUARY 2ND, 1876.*

| Dr. | £ | s. | d. |
|---|---|---|---|
| To Balance of Sundries and Implement Account . | 37 | 4 | 0 |
| „ „ Oat Crop (Couch Field) . . . | 48 | 6 | 1 |
| „ „ 1874 Crops . . . . . | 19 | 9 | 4 |
| „ Interest on Invested Capital, viz.:— | | | |
| „ 3 Months at 5 per cent. on £1,900 = £23 15 0 | | | |
| „ 9 „ „ „ 1,300 = 48 15 0 | | | |
| „ Sinking Fund „ 550 = 27 10 0 | | | |
| | 100 | 0 | 0 |
| Balance Profit . . . . | 271 | 18 | 6½ |
| Total . | £476 | 17 | 11½ |

| Cr. | Acres. | £ | s. | d. |
|---|---|---|---|---|
| By Balance, Italian Rye-grass Account . | 17 | 275 | 1 | 1 |
| „ „ Mangolds Crop . . . | 5 | 28 | 0 | 3 |
| „ „ Filter Beds (Market Garden) . | 3 | 17 | 19 | 3 |
| „ „ Permanent Pasture . . | 56 | 30 | 14 | 4 |
| „ „ Oat Crop . . . . | 4 | 6 | 12 | 6 |
| „ „ Barley Crop . . . | 4½ | 23 | 15 | 9 |
| „ „ Odd Crops (Potatoes, Turnips, &c.) . . . . | 5 | 9 | 2 | 10½ |
| „ „ Oat Crop (Couch Field, from Dr. side) . . . | 6 | — | | |
| Total Acres . . | 100½ | | | |
| By Balance, Dairy and Stock Account . . | | 67 | 13 | 6½ |
| „ „ Tank Sludge . . . . | | 13 | 3 | 4 |
| „ „ Rent . . . . . | | 4 | 15 | 0 |
| Total . | | £476 | 17 | 11½ |

* The Dairy Stock was handed over by valuation, 15th May, 1875, to Mr. George Jackson, who purchases fodder for his stock from the farm.

## BALANCE SHEET FOR THE YEAR ENDING FEBRUARY 2ND, 1877.

| Dr. | £ | s. | d. |
|---|---|---|---|
| To Balance of Couch Field Turnips (6 Acres) . | 0 | 0 | 9 |
| (Above level of Tanks manured with Sludge.) | | | |
| „ Balance of Loss on 1875 Crops Account. . | 3 | 0 | 1½ |
| „ „ „ Tank Sludge . . . | 1 | 0 | 2 |
| „ „ Horse Labour . . . . | 23 | 3 | 6 |
| „ „ Sundries and Implements . . | 24 | 4 | 0 |
| „ Interest at 5 per cent. on £1,600 . £80 0 0 | | | |
| „ Payment to Sinking Fund, 5 per cent. on £700. . . . 35 0 0 | | | |
| | 115 | 0 | 0 |
| (To pay off cost of permanent improvement during term of lease.) | | | |
| „ Balance Profit on the Year's Farming . . | 392 | 19 | 0½ |
| Total . . . | £559 | 7 | 7 |

| Cr. | Acres. | £ | s. | d. |
|---|---|---|---|---|
| By Balance Italian Rye-grass Account . | 17 . | 229 | 2 | 11 |
| „ „ Mangolds . . . . | 6½ . | 56 | 6 | 11½ |
| „ „ Market Garden . . . | 5 . | 52 | 2 | 3 |
| „ „ Permanent Pasture . . | 52 . | 52 | 2 | 7½ |
| „ „ Wheat Crop. . . . | 5 . | 55 | 6 | 6 |
| „ „ Oat „ . . . . | 4 . | 22 | 6 | 4 |
| „ „ Potato „ . . . . | 4 . | 20 | 4 | 0 |
| „ „ Dairy . . . . . | 0 . | 38 | 15 | 8 |
| „ „ Rent . . . . . | 1½ . | 33 | 0 | 4 |
| Total Acres . | 95 | | | |
| Total . . . | | £559 | 7 | 7 |

## BALANCE SHEET FOR THE YEAR ENDING FEBRUARY 2ND, 1878.

| Dr. | £ | s. | d. |
|---|---|---|---|
| To Valuation of Live and Dead Stock . . | 877 | 3 | 2 |
| „ „ Permanent Improvements. . | 786 | 6 | 5 |
| „ Wages . . . . . | 464 | 5 | 6½ |
| „ Rent, Rates, and Taxes . . . . | 455 | 6 | 7 |
| „ Other Payments. . . . . | 160 | 10 | 8 |
| „ Interest on Capital at 5 per cent. on £1,600 . . . . £80 0 0 | | | |
| „ Payment to Sinking Fund at 5 per cent. on £800 . . . . 40 0 0 | | | |
| | 120 | 0 | 0 |
| (To pay off cost of permanent improvement during term of lease.) | | | |
| „ Balance, Profit on Year's Farming. . . | 105 | 2 | 5 |
| | £2,968 | 14 | 9½ |

| Cr. | £ | s. | d. |
|---|---|---|---|
| By Receipts . . . . . | 1,188 | 4 | 8 |
| „ Sundry Debtors . . . . . | 154 | 19 | 9½ |
| „ Valuations, Live and Dead Stock . . | 818 | 4 | 0 |
| „ „ Permanent Improvements. . | 807 | 6 | 4 |
| | £2,968 | 14 | 9½ |

In the villages of the West Riding of Yorkshire, which contain from 2,000 to 7,000 people each, and no water-closets, the value of sewage appears to be recognized, for, in a day's walk in that part of the country, scores of instances will be seen of the slop-water from a house or a row of houses being carried by a gutter on to a sloping meadow instead of into a ditch. At Idle, Cullingworth, and Harden, near Bradford, this has been done on a somewhat systematic and more extended scale, apparently with very satisfactory results.

From the foregoing notes it appears—

1st. That there are upwards of 100 owners and occupiers of land in Great Britain who use sewage for the sake alone of what they can get out of it by agricultural means.

2nd. That of this number more than 60 are tenant farmers who continue to use it although they have, annually at least, the option of ceasing to do so.

3rd. That of the latter number about five-sixths, and of the total number about three-fourths, actually pay money for the use of the sewage, either in the form of out-fall rent, unquestionable increase of land rent, or the price of occasional dressings.

Nearly four thousand acres of sewage land have been referred to, and these are in the hands of more than a hundred distinct occupiers. These occupiers may be divided into three classes:—

Those who have to cleanse a certain quantity of sewage on a certain area of land;

Those who may take, or leave alone, as much of a town's sewage as they please; and

Those who may take, or leave alone, what sewage can be spared by others having a prior right.

The first class occupies 1,670 acres of sewaged land, and deals with the sewage of twenty distinct sanitary districts,

with an aggregate population of about 200,000, on as many as twenty-one different farms.

Of these twenty-one farms, twelve are let by local authorities to tenants who undertake to cleanse the sewage as well as use it for their own purposes; and nine are held by persons who take the sewage on their land for no other reason than the belief that their holding will be benefited by it. Now, it is a fact deserving the notice of local authorities, as well as of private users of sewage, that while ten out of the twelve authorities having sewage to use, manage to become owners or lessees of *arable* farms, six out of the nine agriculturists who take sewage with all its liabilities for the sake only of fertilizing their land, happen to occupy permanent grass farms. Now, taking the second class, composed of persons using as much or little sewage as they please. These are sixteen in number, and, with the sewage of about a quarter of a million people at their command, irrigate amongst them nearly 1,500 acres.

This area, with the exception of part of the Edinburgh land, about an acre of osiers at Tyldesley, and part of the Handsworth land, which bears rhubarb, is entirely occupied by permanent grass. The difference between this class of sewage user and the first, consists in this one having the power to pass the dirty water on if it is not wanted, and so neglect to prevent river pollution, and cast the duty on some one else. It is of the highest importance, therefore, to establish what are the periods during which the interests of the unfettered sewage farmer dictate that he shall let any one else have the sewage for better or worse.

At Crediton, where sewage is only put on grass land, it appears to be passed on during "most of the summer."

At Devizes, it is not used while the hay is tall or being made.

At Edinburgh, three watermen are employed in summer to irrigate the Craigentinny Meadows, and one in winter.

At Handsworth, it runs on to grass land all the year round.

At Leek, the outfall, commanding meadows only, discharges on to those meadows during the whole year except about six weeks or two months, when the growth of the grass prevents access to the channels without damage to the crop.

From Mansfield, the Duke of PORTLAND'S bailiff, Mr. WOODS, kindly reports that there is no season of the year at which the water cannot with advantage be turned on to the Clipstone Meadows.

At Plympton, the occupiers of LORD MORLEY'S Meadows are "crazy after the sewage," excepting during two or three months in the summer.

At Waltham Abbey, the town mead is irrigated from the middle of September till the beginning of May, when the occupier of the adjoining market garden takes the sewage.

These few notes show that the grass farmer can, without any scheming, do with sewage till May. Then comes the very important note from Leamington (where Lord WARWICK has produced sewage-grown roots to win ten silver cups and a number of money prizes) that "Root crops, with the exception of cabbages, never have sewage applied to them before May or June;" and another from Arle Court Farm, Cheltenham (where many prize mangolds have been grown) that Mr. WOOD has mangold on the same ground five years running.

Now, the third class, into which sewage users have been divided for the purposes of this Paper, includes some sixteen or eighteen farmers at Leamington and Cheltenham, who, together, irrigate about 500 acres of land when the sewage can be spared to them. For this advantage they have been found ready to pay nearly £200 a year, besides doing such work as the land may require before it

can be irrigated. What has been done at these two places goes principally to show that a farmer can, under a great variety of circumstances, if he chooses, try a dressing of sewage on his field (whether arable or pasture) without any such outlay as would only be justified after he had determined to irrigate permanently.

To any one desirous of trying the use of sewage on their land, but unacquainted with the practice, it will be satisfactory to learn that at no place mentioned (with seven exceptions) do the surface carriers, great or small, consist of anything but spade or plough cut channels. At Aberdeen and Guisborough, however, they are made of earthenware channel-pipes; at Penrith, channel-pipes are used for the permanent carriers, and portable wooden spouting is used for branch purposes. These both appear troublesome features—the one to keep in repair in a field occupied by cattle, the other to use; and their merit is by no means apparent. At Altrincham, channel pipes were laid, but have, in a very large measure, been removed in favour of the simple grip. At Swinton the land first laid out had channel-pipes; but, in extensions, spade-cut furrows have taken their place. At Wrexham, solid channels are only used where the necessary proximity of their position to that of a pure watercourse makes them desirable; or where the gradients are so steep that channels simply cut in the ground would not stand. At Ware, the main carrier consists of a wooden spout packed up on legs or laid in the ground at regular gradients, and from this the sewage is carried on to the land, as at Penrith, by means of smaller portable spouting.

The amount of alteration required by the surface before land can be satisfactorily irrigated with sewage must of course vary with localities; but what has been done at Leamington and Warwick by some fifteen users of sewage, both on meadow and arable land, as well as at Chorley,

and several of the places where grass land has been irrigated, proves that, under very varying conditions, it is practicable to irrigate land with the same surface that has been given to it by the process of ordinary farming.

Besides the cost of great levelling operations, the tendency they have to rob parts of the surface of their share of soil, is a decided disadvantage. Few accurately-levelled fields of rye-grass are free from patches of a yellowish colour, which, on investigation, turn out to be due to want of soil.

From what has been said about tanks, it is plain that they are only useful under certain circumstances, and that they require careful handling to prevent them from being a nuisance.

Upon the question of whether or no it is dangerous to graze and irrigate land at the same time, much valuable evidence has been adduced on the negative side, while none to the contrary has come under the author's notice.

That heavy as well as light land may be profitably irrigated has been proved at Cheltenham, Crediton, Chorley, Leamington, and Swinton. It must not, however, be wanting in drainage; but if land be sufficiently drained, either naturally or artificially, for advantageous farming without sewage, it is sufficiently drained for the most advantageous use of sewage. Heavy land, however, under sewage should be laid down in pasture, for sewage adds considerably to the labour and difficulty in working it.

Climate has, no doubt, considerable influence upon all agricultural phenomena, but no variety to be met with in this kingdom south of Edinburgh seems to be inconsistent with the profitable use of liquid sewage. The meteorological character of the country varies very considerably between Edinburgh and Plympton; for, while the average annual rainfall at the latter place must be nearly fifty inches, that of Edinburgh is under thirty, and places situated at inter-

mediate latitudes, where sewage has been profitably used, have annual rainfalls varying from the twenty-five inches registered at Chelmsford and Guisborough, to double that amount at Penrith, Cockermouth, and Cleator Moor.

The question of whether the separate system of sewerage is desirable or not requires a few words. It concerns, principally, those who are obliged to cleanse all the sewage that comes to them. There are twenty-one such cases referred to, and the Author is in a position to know that, in fourteen of them, those most interested would gladly see storm waters kept out of the sewers. Thirteen of these gentlemen, including Mr. BLACKBURN, Colonel JONES, Admiral CHALONER, and Captain FOSBERY, speak from experience of arable farms, and there can be little doubt that they are right; but with grass land the question is not of such importance. Subsoil water, which makes a less varying addition to the flow of sewage, is probably always an advantage to the sewage farmer, provided only he has enough land for the proper utilization of all the manure contained in the sewage he has to deal with.

The sewage of a town has never, probably, been spread over enough land for its complete utilization; and one thing that must always make this difficult, in the majority of cases, is the absence of available water in sufficient quantities to spread the sewage where it is required in summer, and to irrigate the already highly-manured land, which requires moisture rather than manure. It is plain, from the table referring to the Leamington farm, that, the field which received nearly fifteen thousand tons of sewage per acre, between the 8th of February and the end of August last year, a very large proportion of the manure must have been wasted, for, supposing the average manurial value of the refuse of the Leamington population to be 10*s.* per head per annum, then the value of the dressing per acre

would be about £107, which is, probably, at least four times the value of the crop that it could produce.

"Sewage sickness" is a term that has become common, because it sounds appropriate; but, as a matter of fact, time has no effect in making land "sewage sick," for its pores may be filled, as at Edinburgh, year after year, with infinitely more dissolved manure than can possibly be made use of by vegetation; and the land will continue to be as productive and as capable of receiving sewage as ever. A crop may, however, be ruined if it is covered with sewage, even although it may not have had enough for its manurial requirements; or land may be done more harm to than good, temporarily, by one single ill-timed dressing. Experience has proved that over feeding with sewage for years has no ill effect, although land may be choked with it in one meal.

At none of the places mentioned, excepting one, has the use of sewage involved the user in litigation. The Ware Local Board were, however, a few years ago, summoned before the magistrates by the Lee Conservancy, who alleged that sewage was allowed to run over the surface of the ground into the river, but the case was dismissed.

The object of this Paper has been to lead to an increase in the present number of sewage farmers. If this is to come about largely, sewers must be laid out with a view to commanding by their outfalls (or by outfalls that might be made if required) the greatest area of land, and the greatest number of agricultural properties or holdings. Would-be sewage farmers must bear in mind that there is a large variety of circumstances under which it would be possible, and very advantageous to a town, to send part of its sewage to a farm, although that farm may be at level considerably above the general outfall level of its whole system of sewers.

Advocates of sewage precipitation processes should not regard sewage farmers as their rivals; for a chemical pro-

cess might be very largely used with advantage where farmers are being persuaded or taught to use sewage. But this should be the distinct aim of all authorities; for there is no chemical process that could not be worked to greater advantage during two months of the year than twelve, or applied to a small quantity of sewage at less cost than to a large.

In conclusion, thanks are due to the many gentlemen in nearly every district who have given valuable assistance towards the preparation of the statistics of this Paper.

The President announced that it had been arranged, with the Author's concurrence, that the discussion on the Paper should be postponed until after the recess.

A vote of thanks to Mr. Birch having been put and carried unanimously, the Meeting adjourned.

## TABLE No. 1.

| | Population. | Process. | Interest on Loan at 3½ per cent. | Loss in Working. | Gain in Working. | Total Annual Cost. | Cost per Head per Annum. |
|---|---|---|---|---|---|---|---|
| | | | £ | £ | £ | £ | *s.* *d.* |
| Blackburn . . . . | 90,000 | Irrigation | 3,394 | 1,226 | — | 4,620 | 1 0¼ |
| Merthyr . . . . . | 53,330 | „ | 1,866 | 1,067 | — | 2,933 | 1 1¼ |
| Tunbridge Wells. . . | 23,000 | „ . | 3,186 | 528 | — | 3,714 | 3 2¾ |
| Wolverhampton . . . | 71,000 | „ | 1,330 | — | 646 | 684 | 0 2¼ |
| West Derby . . . . | 31,400 | „ | 2,217 | — | 1,015 | 1,202 | 0 9 |
| Kendal . . . . . | 13,700 | Filtration | 660 | — | 385 | 275 | 0 4¾ |
| Leeds . . . . . | 285,000 | Precipitation | 2,135 | 15,000 | — | 17,135 | 1 2½ |
| Bradford . . . . . | 173,723 | „ | 2,100 | 6,276 | — | 8,376 | 0 11½ |
| Coventry . . . . . | 40,000 | „ | 420 | 2,850 | — | 3,270 | 1 7½ |

HEATHCOTE FARM.—*Crops and Quantities of Sewage applied in* 1877.

| CROP. | Acreage. A. | R. | P. | Times dressed. | Total Tons of Sewage. | Tons per Acre. | Value of Sewage per Acre. £ | s. | d. | Tons per Acre per dressing. |
|---|---|---|---|---|---|---|---|---|---|---|
| Permanent Pasture and Italian Rye-grass | 33 | 0 | 0 | 29 | 393,643 | 11,928 | 87 | 4 | 6 | 411 |
| Italian Rye-grass | 8 | 0 | 0 | 26 | 85,468 | 10,708 | 76 | 10 | 6 | 412 |
| Ditto ditto | 8 | 2 | 0 | 27 | 93,979 | 11,056 | 80 | 17 | 0 | 409 |
| Ditto ditto | 4 | 0 | 0 | 36 | 58,510* | 14,627 | 107 | 0 | 0 | 401 |
| Ditto ditto | 8 | 0 | 0 | 14 | 45,938 | 7,492 | 54 | 16 | 0 | 535 |
| Ditto Strawberries and Rhubarb | 10 | 1 | 34 | 18 | 72,128 | 2,585 | 18 | 18 | 0 | 144 |
| Fallow for Oats | 7 | 0 | 0 | 20 | 56,378 | 8,054 | 58 | 18 | 0 | 402 |
| Ditto for Mangold | 5 | 1 | 12 | 15 | 30,913 | 5,805 | 42 | 8 | 6 | 387 |
| Cabbage | 4 | 2 | 0 | 5 | 16,333 | 3,630 | 26 | 10 | 6 | 726 |
| Ditto | 5 | 0 | 0 | 4 | 9,481 | 1,896 | 13 | 16 | 6 | 474 |
| Mangold | 14 | 0 | 14 | 13 | 89,568 | 6,358 | 46 | 10 | 0 | 489 |
| Ditto | 7 | 0 | 0 | 23 | 58,664 | 8,380 | 61 | 6 | 0 | 364 |
| White Turnips | 3 | 0 | 0 | 2 | 3,133 | 1,044 | 7 | 12 | 6 | 522 |
| Italian Rye-grass | 11 | 0 | 36 | 32 | 14,3638 | 12,796 | 93 | 11 | 6 | 400 |
| Savoys | 2 | 0 | 0 | 2 | 2,173 | 1,086 | 7 | 19 | 0 | 543 |
| Fallow for Turnips | 20 | 0 | 0 | 5 | 42,000 | 2,100 | 15 | 7 | 0 | 420 |
| Italian Rye-grass | 20 | 1 | 17 | 7 | 32,268 | 1,585 | 11 | 11 | 0 | 226 |
| Parsnips and Cabbage | 9 | 0 | 4 | 10 | 45,000 | 4,986 | 36 | 9 | 0 | 499 |
| Permanent Pasture | 10 | 3 | 24 | 4 | 17,500 | 1,605 | 11 | 14 | 6 | 401 |
| Fallow for Mangold | 9 | 1 | 29 | 4 | 17,500 | 1,916 | 14 | 0 | 0 | 479 |
| Sewage supplied to Farmers | | | | | 190,000 | | | | | |
| Total | | | | | 1,504,215 | | | | | |

* The whole of this quantity was applied between the 8th February and 31st August.

NOTE.—100 tons of sewage per acre represents a dressing an inch thick.

# THE ANNUAL GENERAL MEETING,

*Monday, May 27th,* 1878.

EDMUND JAMES SMITH (PRESIDENT) IN THE CHAIR.

Messrs. W. W. LEE and C. J. MANN, having been requested to act as Scrutineers of the ballot for the Election of Council, the balloting list submitted by the Council in accordance with the bye-laws, and the record of attendance of the Members of Council, were read, and the ballot declared open.

The Report of the Council on the state of the Institution and the Statement of Receipts and Expenditure for the year 1877 were read.

RESOLVED—"That the Report of the Council and the Balance Sheet be received and approved, and be printed and circulated with the 'Transactions.'"

RESOLVED—"That the thanks of the Institution be given to Messrs. A. GARRARD and R. VIGERS for the efficient performance of their duties as Auditors, and that they be requested to continue their services for the ensuing year."

RESOLVED—"That the thanks of the Institution are due and be given to the President, the Vice-Presidents, and the other Members and Associates of Council, for the able manner in which they have administered the affairs of the Institution."

RESOLVED—"That the thanks of the Institution be given to Mr. JOHN WORNHAM PENFOLD (the Honorary Secretary), to Mr. JULIAN C. ROGERS, to the Treasurer, and other Officers of the Institution, for the able manner in which they have executed their several duties."

The ballot having been closed, the Scrutineers reported that the following gentlemen had been elected as Council for the ensuing year :—

*President.*

WILLIAM STURGE.

*Vice-Presidents.*

| | |
|---|---|
| EDWARD RYDE | EDWARD I'ANSON |
| THOMAS SMITH-WOOLLEY | WILLIAM JAMES BEADEL |

*Members of Council.*

| | |
|---|---|
| ROBERT COLLIER DRIVER | CHARLES STEPHENSON |
| FRANCIS VIGERS | DANIEL WATNEY |
| VIRGOE BUCKLAND | WILLIAM SCARTH |
| CHARLES JOHN SHOPPEE | JAMES MARTIN |
| THOMAS CHATFEILD CLARKE | THOMAS BINNIE |
| ELIAS PITTS SQUAREY | ALFRED OWTHWAITE SEDGWICK |

*Associates of Council.*

| | |
|---|---|
| RICHARD BOXALL GRANTHAM | FREDERICK ADOLPHUS PHILBRICK |

RESOLVED—"That the thanks of the Meeting be given to Messrs. W. W. LEE and C. J. MANN, for their services as Scrutineers."

A vote of thanks to the Past-President for his conduct in the Chair having been passed unanimously, the Meeting separated.

# THE TENTH
# ANNUAL REPORT OF THE COUNCIL.

*Annual General Meeting, May 27th,* 1878.

The Council feel great satisfaction in calling attention to the fact that this Report marks the close of the first decade of the existence of the Institution. During the whole of this period, the prosperity of the Institution has been steadily progressive; and the Council are not aware of any particular in which the results have failed to justify the aims and endeavours of those who have been, from year to year, responsible for the conduct of its affairs.

In the course of these ten years the Council has undergone considerable changes, and has suffered several losses. Of those who formed the first Council, 5 have passed the Chair, 2 others have died, and 6, from ill-health or other causes, have not offered themselves for re-election. In the course of the ten years, the general body has been represented on the Council by 32 Members and Associates.

Out of the general body of the Members and Associates, 40 have died during the period under review, and although the mere numerical loss thus sustained has been far more than counterbalanced by the addition of new Members and Associates, the Council cannot fail to recollect that among these 40 were many of whose services the Institution will always retain a grateful recollection, and whose places will not easily be adequately filled. The loss of Members from other causes has been very small indeed, and has been due, with few exceptions, to the retirement of some of the older Members from business.

If any were still disposed to undervalue the services which the establishment of the Institution has rendered, the one fact that, in the course of these ten years, the fortnightly Meetings have called a large professional literature into existence, for the use of its Members, would be conclusive on the point. It has been the study of the Council to preserve the practical character of this literature by discouraging the publication of any matters of a general or discursive kind, and it remains with the Members to maintain the present high character of the "Transactions," by contributing Papers worthy of the Institution. The Council propose, for the further convenience of Members, to direct the preparation of an exhaustive Index to the ten published volumes of the "Transactions."

During the twelve months just closed, 7 Members and 16 Associates have been admitted into the Institution. During the same period 6 Associates, having become eligible, have been transferred to the class of Members, and 3 Students to that of Associates. The Institution now numbers 8 Hon. Members, 304 Members, 134 Associates, and 8 Students; or, 454 of all classes.

Neither Mr. Richard Hall, Past-President, nor Mr. John Oakley, Vice-President of the Institution, had been able, for some time past, to take so active a part as formerly in the direction of the affairs of the Institution, but their influence was, up to the last, exercised in promoting its interests, and their names will remain identified with its history. By the decease of Mr. Bravender, the best Botanical Surveyor has left us; by that of Mr. S. D. Martin, one of the last of the Chain Surveyors has departed; and by that of Mr. Menzies, we have lost one of the best authorities on arboriculture and on sewerage, and one who, while his health permitted, made several contributions of great co-temporaneous interest to the "Transactions." Memoirs of

these and of other Members of the Institution, whose deaths will be regretted by a wide circle of private and professional acquaintances, will be found among the Obituary Notices appended to this Report.

The revenue derived from subscriptions during the past year exhibits a satisfactory increase, as compared with that of the previous year. There is a continued increase under the head of "Hire of Arbitration Rooms," while at the same time savings have been effected under some heads of expenditure.

In accordance with the intention announced in the last Report, the Council have now resumed possession of the second and third floor rooms, so that the house is now in the sole occupation of the Institution of Surveyors. This step was felt to be fully justified by the financial position of the Institution, and has long been desirable on general grounds, as well as for the special purposes of affording more rooms for Arbitrations. It is in contemplation to make some considerable structural alterations in these rooms, and they will then be available for several purposes for which further accommodation is much needed.

It will be a satisfaction to the Members to observe that a further reduction of the Building Debt by £600 has been made during the period covered by the Balance Sheet annexed, and a sum of £400 has been devoted to this object during the current year. The sum raised by an issue of debenture bonds in the years 1872-3 was £2,925. Of this amount, £2,175 has been cleared off out of surplus funds during the five intervening years, and the debt at the present moment stands at £750. The residue of the debt will, it is hoped, be extinguished within a very short period.

The Balance Sheet for the year ending December 31st, 1877, shows the following results :—

| Receipts. | £ | s. | d. | Expenditure. | £ | s. | d. |
|---|---|---|---|---|---|---|---|
| Total Revenue . . | 1,878 | 5 | 0 | Total payments out of Revenue — Current Expenses . . . . | 1,397 | 14 | 3 |
| Revenue Balance in hand, January 1st, 1877 . . . . . | 85 | 8 | 2 | Transferred to Capital | 490 | 0 | 0 |
| Entrance Fees carried to Capital Account . . . | 170 | 2 | 0 | Revenue Balance in hand, Dec. 31st, 1877 . . . . . | 75 | 18 | 11 |
| Transferred from Revenue . . . | 490 | 0 | 0 | Total payments out of Capital — Building and Furniture . . | 49 | 10 | 0 |
| Capital Balance in hand, January 1st, 1877 . . . . . | 1 | 2 | 7 | Debentures paid off . | 600 | 0 | 0 |
| | | | | Capital Balance in hand, Dec. 31st, 1877 . . . . . | 11 | 14 | 7 |
| | £2,624 | 17 | 9 | | £2,624 | 17 | 9 |

In addition to the above cash balances, Stock to the amount of £347 3*s.* Consols, and £141 16*s.* 9*d.* New Three per Cents. (of which £100 is invested in the Library account), stood to the credit of the Trustees of the Institution of Surveyors on the 31st of December, 1877.

A summary of the Receipts and Expenditure for the present year, up to this date, is as follows:—

| Receipts. | £ | s. | d. | Expenditure. | £ | s. | d. |
|---|---|---|---|---|---|---|---|
| Total Revenue . . | 1,354 | 8 | 10 | Total payments out of Revenue — Current Expenses . . . . | 932 | 15 | 6 |
| Revenue Balance in hand, January 1st, 1878 . . . . . | 75 | 18 | 11 | Interest on Mortgage Debentures . . . | 62 | 17 | 8 |
| Entrance Fees and Life Compositions carried to Capital Account . . . | 411 | 17 | 0 | Revenue Balance in hand, May 23rd, 1878 | 424 | 14 | 7 |
| Capital Balance in hand, January 1st, 1878 . . . . . | 11 | 14 | 7 | Payments out of Capital — Debentures paid off . . . . . | 400 | 0 | 0 |
| | | | | Capital Balance in hand, May 23rd, 1878 . . . . . | 23 | 11 | 7 |
| | £1,853 | 19 | 4 | | £1,853 | 19 | 4 |

In addition to the above cash balances, the amount of

Stock now invested in Consols is £347 3*s.*, and in New Three per Cents., £141 16*s.* 9*d.*

The Library balance in hand is £186 2*s.* 7*d.*, in addition to the £100 invested in New Three per Cents.

The total liabilities for rent, rates, printing, and current expenses amount to about £175.

The fortnightly Meetings of the Institution have been well attended during the Session. Several Papers of great interest and value have been read and discussed; and the Council feel that their acknowledgments are due to the gentlemen who have devoted their time and ability to the preparation of these Papers, and who have so freely placed their knowledge of the various subjects at the service of the Institution.

The Council have continued to follow with care the course of legislation on matters of moment to the profession. As regards the Metropolis Management and Building Acts Amendment Bill, which in its original form comprised objectionable clauses, the Council, at the proposal of Mr. Garrard, have taken special means of exerting any influence at their command. The amendments made in the Select Committee of the House of Commons will, if finally confirmed, render the Bill acceptable both to the profession and to the public.

The Council take the opportunity of again reminding Members and Associates of their obligations as regards the support of the Library, and refer intending Donors, who experience a difficulty in making a suitable selection, to the list of books on the cover of the "Transactions."

In conclusion, the Council return their thanks to the Members for their support, and for the confidence reposed in them.

*Dr.* STATEMENT OF RECEIPTS AND EXPENDITU

## RECEIPTS.

## REVENU

| 1877. | £ s. d. | £ s. d. | £ s. |
|---|---|---|---|
| 278 Members' Subscriptions for 1877, at £3 3*s.* | 875 14 0 | | |
| 1 ,, ,, in advance for 1878 | 3 3 0 | | |
| 10 ,, Arrears, at £3 3*s.* | 31 10 0 | | |
| | | 910 7 0 | |
| 117 Associates' Subscriptions for 1877, at £2 2*s.* | 245 14 0 | | |
| 1 ,, ,, in advance for 1878 | 2 2 0 | | |
| 15 ,, Arrears, at £2 2*s.* | 31 10 0 | | |
| | | 279 6 0 | |
| 9 Students' Subscriptions for 1877, at £1 1*s.* | 9 9 0 | | |
| 1 ,, Arrear | 1 1 0 | | |
| | | 10 10 0 | |
| | | | 1,200 |
| Rent of Offices and Hire of Arbitration Rooms | | | 666 |
| Dividends | | | 11 1 |
| Cash in hands of Treasurer and Secretary, January 1st, 1877 | | | 85 |
| | | | £1,963 1 |

## CAPITA

| | £ s. d. | £ s. d. | £ s. |
|---|---|---|---|
| 13 New Members' Entrance Fees for 1877, at £5 5*s.* | 68 5 0 | | |
| 1 Member's Entrance Fee, Balance on Transfer | 2 2 0 | | |
| | | 70 7 0 | |
| 15 New Associates' Entrance Fees for 1877, at £3 3*s.* | | 47 5 0 | |
| 1 Member's Life Composition | 31 10 0 | | |
| 1 Associate's Life Composition | 21 0 0 | | |
| | | 52 10 0 | |
| | | | 170 2 |
| Cash transferred from Revenue | | | 490 0 |
| Balance in hands of Treasurer, December 31st, 1876 | | | 1 2 |
| | | | £661 4 |

## LIBRAR

| | £ s. |
|---|---|
| Donations, 1877 | 63 11 |
| Dividends | 2 16 |
| Balance in hands of Treasurer, December 31st, 1876 | 171 5 |
| | £237 13 |

## SU

| | £ s. |
|---|---|
| Revenue Account | 1,963 15 |
| Capital ,, | 661 4 |
| Library ,, | 237 13 |
| | £2,862 10 |

## ASSETS AN

| | £ s. |
|---|---|
| Cash in hands of Treasurer and Secretary | 251 7 |
| Value of Furniture and Books | 2,027 16 |
| Invested in New Three per Cents and Consols | 375 10 |
| ,, ,, ,, ,, Library | 100 0 |
| Subscriptions and Entrance Fees due, but unpaid at date | 60 7 |
| Value of Premises, No. 12, Great George Street | 5,000 0 |
| Fees for use of Rooms due, but unpaid at date | 170 2 |
| | £7,985 3 |

R THE YEAR ENDING DECEMBER 31ST, 1877. *Cr.*

## CCOUNT. EXPENDITURE.

| 1877. | £ s. d. | £ s. d. |
|---|---|---|
| t | 246 17 6 | |
| rance, Rates, and Taxes | 138 3 5 | |
| l, Light, and Water | 55 0 4 | |
| | | 440 1 3 |
| erest on Loans | | 90 9 11 |
| airs | | 19 6 9 |
| tionery, Postage and Receipt Stamps, Books of Account, Publications, &c. | | 58 15 11½ |
| aries and Wages | | 497 7 5 |
| and Coffee at Meetings | | 7 18 11½ |
| sehold Effects and Housekeeper's Petty Cash Expenses | | 23 19 2 |
| lication of "Transactions"—Printing | 197 4 9 | |
| Covers and Binding | 16 11 7 | |
| Reporting | 37 16 0 | |
| | 251 12 4 | |
| Less Sale of ditto | 33 14 6 | |
| | | 217 17 10 |
| aeral Printing | | 41 17 0 |
| nsferred to Capital Account, for Furniture and Redemption of Bonds | | 490 0 0 |
| h in hands of Secretary | 20 0 0 | |
| „ Treasurer | 55 18 11 | |
| | | 75 18 11 |
| | | £1,963 13 2 |

## CCOUNT.

| | £ s. d. |
|---|---|
| niture and Fittings | 49 10 0 |
| emption of Bonds | 600 0 0 |
| ance in hands of Treasurer | 11 14 7 |
| | £661 4 7 |

## CCOUNT.

| | £ s. d |
|---|---|
| chase of Books | 73 18 11 |
| ance in hands of Treasurer | 163 14 3 |
| | £237 13 2 |

## ARY.

| | £ s. d. |
|---|---|
| enue | 1,886 5 11 |
| ital | 649 10 0 |
| ary | 75 7 3 |
| ance in hands of Treasurer and Secretary | 251 7 9 |
| | £2,862 10 11 |

## IABILITIES.

| | £ s. d. |
|---|---|
| Quarter's Rent, to Christmas, 1877 | 62 10 0 |
| l, Housekeeping, Printing, and Various Accounts | 180 14 4 |
| rest due on Debentures | 6 0 0 |
| ebenture Bonds at £25 each | 1,150 0 0 |
| ance | 6,585 19 2 |
| | £7,985 3 6 |

Examined with the Books and Vouchers, and found correct,
May 14th, 1877.

ROBERT VIGERS,
ARTHUR GARRARD, } *Auditors.*

# APPENDIX TO VOL. X.

## Obituary.

THOMAS ABBOTT (Member) was a son of Mr. Abbott, surveyor and auctioneer, of Christchurch, Hants. He was articled to Mr. Salmon about the year 1850, and, on the expiration of his articles, entered the office of the late Mr. H. E. Marsh (Member), of Charlotte Row, with whom he remained as principal assistant until, in 1862, he became a partner in the firm of Rushworth & Jarvis. Mr. Abbott died, after a long and painful illness, on January 14th, 1878.

JOHN BRAVENDER (Member) was born in Yorkshire, and from his earliest youth was connected with agricultural pursuits. His father was a tenant of Lord Hotham, and his grandfather of the Osbaldestone family.

Mr. Bravender began his professional career as articled clerk to Mr. Metcalf, of Monmouth. Leaving Monmouth in 1828, he entered the office of Mr. Trinder, of Cirencester. Soon after commencing business on his own account, the "Tithe Commutation Act" was passed. Mr. Bravender became extensively occupied in the business thus created, and acquired a local knowledge, which soon ripened, under the influence of the teaching of the celebrated land-agent, William Smith, into a thorough scientific acquaintance with the geological characteristics of the neighbourhood in which he resided. This was no easy matter in those days, when English geology was in

its infancy, and the individual observer had little to guide him in the shape of formulated knowledge. Mr. BRAVENDER rapidly became an authority on the qualities of soils, and their suitability for various descriptions of crops, and contributed several valuable prize essays—notably one on "The Indications of the Fertility or Barrenness of Soils"—to the "Journal of the Royal Agricultural Society." Though in failing health for some time previous to his death, Mr. BRAVENDER's interest in scientific matters never abated. In proof of this, Members of the Institution may be reminded that the last published volume of these "Transactions" contains a very interesting section of the Boxwell Spring, contributed by Mr. BRAVENDER in illustration of Mr. LUCAS's Paper, read in February of last year.

The Town of Cirencester has lost in Mr. BRAVENDER one who had long been accustomed to take an active part in public affairs as one of the old Town Commissioners, and as a member of the New Local Board. Mr. BRAVENDER had managed for many years the local estates of the late Earl of ST. GERMANS. He died on the 5th of January, 1878, in the 75th year of his age.

RICHARD HALL (Past-President) was born in 1806 at Cirencester, in Gloucestershire, where his father and grandfather had been the leading land-agents for many years, but his father dying when he was a very young man, the business was carried on by his grandfather, who lived to the age of 93. When Mr. HALL became of age in 1827, the greater part of the business had gone elsewhere, but Mr. HALL's skill and energy restored at once a considerable part of it, and the passing of the Tithe Act, in 1836, gave him the opportunity of recovering almost the whole of the old connexion. On the establishment of, and during the growth of, the railway system, Mr. HALL was much

concerned (mainly on behalf of the companies, but frequently also on that of owners) in the settlement of land purchases and sales, and in this way became associated with the late Mr. I. K. Brunel, who thoroughly appreciated his skill and soundness of judgment. Through his connection with this eminent engineer, he was employed in the purchase of a large portion of the present Great Western Railway system.

Among other events of his earlier life may be mentioned the assistance which he rendered in establishing the Agricultural College at Cirencester.

About 1850, Mr. Hall removed to London, where his general practice, particularly in Parliamentary work, and in the capacity of arbitrator or umpire, rapidly increased, and it may perhaps be mentioned that there are few to whom it has more frequently fallen to have the settlement of matters on both sides left entirely in their hands. On several occasions the Government availed itself of Mr. Hall's skill and knowledge,—notably in the settlement of the basis of rateable value of the large dockyards and other establishments occupying areas which previously contributed nothing to the poor rates. For some few years previous to his death Mr. Hall had retired from the more arduous duties of his profession, but his interest in its welfare remained unabated; and when the project of founding the Institution of Surveyors was first mooted, Mr. Hall at once evinced the strongest sympathy with the movement, and contributed not a little to its success.

He was one of the first four Vice-Presidents, and succeeded Mr. Clutton in the Presidency of the Institution at the expiration of his term of office in May 1870. During the two years of his Presidency, Mr. Hall exerted himself to consolidate the work, the foundations of which were so well laid by his predecessor, and by the influence of

his personal popularity attracted a large number of his professional brethren to the new Society. By the Members of the Institution Mr. Hall will long be held in affectionate remembrance. His amiable and conciliatory disposition, the gentleness of his manners, and the transparent honesty of his character, won the liking and respect of all with whom he came in contact; and it may without exaggeration be said that it has seldom fallen to the lot of a professional man to attach to himself so much goodwill and steer so clear of personal enmities in the course of a long and active business career. Mr. Hall was the principal adviser of several noblemen and large landowners, and held at the time of his death, which occurred on the 22nd of February last, several prominent public offices. He was also a Deputy-Lieutenant for the county of Brecon, and a Magistrate for Glamorganshire.

SAMUEL DICKINSON MARTIN (Member), who died on the 26th September last, at his residence, Beech Grove, Harrogate, was born 12th June, 1803, and was consequently in his 75th year.

Mr. Martin was a pupil of Mr. George Leather, C.E., of Leeds, his native town, where he commenced business, in 1824, as a civil engineer and surveyor, and practised without intermission till the time of his death. He also had offices at 24, Great George Street, and in Park Street, Westminster, for several years, during the busy period of railway enterprise which began in 1843. He was extensively employed on the Parliamentary surveys of many of the principal railways in England, including the Manchester and Leeds Railway, under the direction of Mr. George Stephenson; the London and York; North Midland; Leeds and Thirsk; Eastern Counties Extension; West Riding Union; Leeds and Bradford and its Extension;

Northumberland Atmospheric, under Mr. Brunel; the South-Eastern Lines through North and Mid-Kent; and numerous other projects. For a great number of years he never missed a Parliamentary Session without being actively engaged in promoting or opposing one or more important railway Bills. He had the good fortune to possess the personal friendship of some of the most eminent engineers and surveyors of the day, and enjoyed the esteem of a very large circle of professional as well as private friends.

For many years past Mr. Martin was in great request as an arbitrator in Yorkshire and the Northern Counties, where his sound judgment and sterling integrity were justly held in high repute.

He was senior partner in the firm of Martin and Fenwick, of Leeds; his son-in-law, Mr. Fenwick (who succeeds him), having been associated with him more or less professionally since 1844, and in partnership during the last seventeen years. Mr. Martin was an Associate of the Institution of Civil Engineers, and the founder and past-president of the Yorkshire and North of England Land-agents and Surveyors' Association.

The advantages to be expected from the establishment of the Institution of Surveyors were at once appreciated by Mr. Martin, who took great interest in its formation and was one of the earliest Members.

WILLIAM MENZIES (Member) was the son of Mr. Menzies, the agent to the estates of Lord Viscount Keith's trustees in Scotland. He commenced his professional career as assistant, for nearly two years, to Mr. R. H. Moncrieff, agent and trustee on many estates in Perthshire, and was afterwards, for four years, assistant to Mr. Gunn, agent upon the Duke of Sutherland's estate at Dunrobin.

About the year 1849, Mr. Menzies was appointed, and remained until his death, sole agent or manager of the Crown property of Windsor Forest and Park. In this capacity he became favourably known to the late Prince Consort, whose interests he served with much devotion, and who held him in great and deserved esteem. Mr. Menzies was elected a Member of the Institution of Surveyors in December 1868, soon after its formation. He at once threw himself, with characteristic energy, into the battle which was then raging over the question of sewage utilization, and contributed a Paper of great contemporaneous interest to the pages of the "Transactions," in which he appeared as an ardent champion of the "separation system." Mr. Menzies was naturally fitted to be a protagonist in a contest of this kind. His habits of mind were of the most practical description, his character was bold and confident, and his disdain of untested theories unmeasured. His agricultural knowledge was considerable, but his knowledge of forestry might fairly be called exceptional, and his love of the subject was evidenced by the elaborate works which he published in 1864 and 1875, under the titles of "History of Windsor Great Park and Forest" and of "Forest Trees and Woodland Scenery."

Up to the period when his health began to decline, Mr. Menzies was much occupied in sanitary and drainage works, in and about Windsor Castle and Park. Those works were described by him in a very interesting Paper in the "Transactions" of the Institution, and are evidence of the zeal and ability which he brought to bear upon every subject which engaged his attention.

Mr. Menzies died at his residence, near Virginia Water, on Friday, the 3rd of May, after a painful and lingering illness, which had totally incapacitated him for work for many months before his death.

JOHN OAKLEY (Vice-President) was born at Deal on April 5th, 1809, and was left an orphan in early boyhood.

His guardians gave him the best education that the neighbourhood afforded; and he was one of the first pupils of the rather famous school, founded by Mr. WHITEHEAD, at Ramsgate, to which so many East Kent boys have owed a good education. He was also for some time a pupil of the late Vicar of Folkestone, the Rev. Mr. PEARCE. Here, perhaps, he formed the strong taste for field sports, for which he was distinguished to the end of his life. The solid foundations of the liberal education laid in early youth were not however thrown away, but strongly influenced his whole career and character.

At 21, Mr. OAKLEY became a tenant farmer, and his modest inheritance was invested in two large farms in the parishes of Frindsbury and Cooling, near Rochester, in Kent, where he soon came to the front amongst his neighbours in farm valuations, tithe commutations and apportionments, parish rating, and the like. About 1840, he was much occupied with business of this kind in several parts of Kent. His vigorous, but sympathetic treatment of his farm-labourers during the agitation at the time of the passing of the Reform Bill, marked him as a young man of conspicuous ability and force of character.

In 1843 he migrated to a larger farm on the other side of Rochester, in the parish of Gillingham. He had by this time become a valuer of considerable practice, with an office in Rochester. During this period he was invited to join the well-known firm of HOGGART and NORTON, as it then was, and for three or four years he remained a member of it. In 1850 he accepted the resident agency of Lord SOMERS's property in Herefordshire and Worcestershire. On leaving Kent for this new home and work Mr. OAKLEY's popularity amongst all classes of his neighbours

was shown by a public dinner and the presentation of an address which bears the names of the principal magistrates and other chief citizens of Rochester and the surrounding district.

Leaving Herefordshire in 1853 (shortly after the present Lord Somers inherited the property), he settled in London, and became in a short time, what he continued to be until his death, one of the most prominent men of business, as Surveyor, Estate Agent, and Auctioneer, in London. He did most of the valuation of property for the Main Drainage, and much for the Thames Embankment Scheme.

In 1857, he became a partner in, and the leading member of, the old firm of Daniel Smith & Son, a partnership which happened to come to a close almost simultaneously with Mr. Oakley's life, the business remaining in the hands of his second son and successor, Mr. Christopher Oakley.

Mr. Oakley was one of the founders, and, for the first few years of its existence, one of the most earnest supporters of the Institution. Failing health, however, compelled him to withdraw from active participation in its affairs, and was his reason for declining to be put into nomination for the Presidency, a distinction for which he was eligible by seniority, and to which he would have been elected without a dissentient voice.

A remarkable natural aptitude for arithmetic and mathematics,—especially in the direction of mental arithmetic,—contributed not a little to Mr. Oakley's professional success, and, added to other qualities of an exceptional kind, stood him in good stead in his constant intercourse with the leading members of his own and other professions, with whom he was so frequently associated, either as witness or as arbitrator in Compensation and other Cases connected with the valuation of land. Mr. Oakley enjoyed an

extraordinary reputation for frankness and fearlessness of character, qualities which, combined with a large measure of natural sagacity and a striking presence, enabled him to acquire early, and retain to the end of his life, a position of prominence in his profession.

In private life he was distinguished by singular generosity of heart and hand, and many have good reason to remember the ready counsel and the readier aid which was always at the service of those who were in distress or difficulty.

Mr. Oakley's health had not been good for several years, a form of suppressed gout having troubled him greatly and seriously affected his heart. His death, which occurred on February 6th, 1878, was due, immediately, to congestion of the lungs, acting on an enfeebled system, and was comparatively sudden,—overtaking him, in fact, almost in the act of saying grace, a closing circumstance in harmony with the simple unaffected piety which marked his character through life.

GEORGE PRICKETT (Member) was born in the year 1816 at Highgate, where his father and grandfather had been established in business as Surveyors and auctioneers for upwards of 150 years. He was for many years (during fifteen of which he acted on behalf of the Great Northern Railway) in general practice as a Surveyor, and was concerned in a large number of important compensation cases. Mr. Prickett was elected a Member of the Land Surveyor's Club in 1853, and of the Institution of Surveyors in 1868. He died at his residence, Maple House, Finchley, on November 8th, 1877, aged 61 years.

JOHN WIMBLE (Member) was born at Maidstone, and was educated at Tunbridge School, on leaving which he

was articled to Messrs. Whichcord & Son, of his native town. On the expiration of his articles Mr. Wimble came to London, and quickly established a considerable practice as an Architect and Surveyor. In the latter years of his life, he was engaged in many compensation cases connected with improvements promoted by the Metropolitan Board of Works and with the operations of the School Board for London. His architectural practice, especially in the City, was considerable, and had his life been spared would probably have become extensive. Mr. Wimble was elected a Member of the Institution of Surveyors in May 1873. His death occurred on the 29th June, 1877, at the early age of 39.

## CONTRIBUTIONS IN MONEY TO LIBRARY FUND,

*From June 1st, 1877, to June 1st, 1878.*

| | £ | *s.* | *d.* |
|---|---|---|---|
| Balls, J. M. | 2 | 2 | 0 |
| Batten, J. W. | 2 | 2 | 0 |
| Birch, R. W. P. | 2 | 2 | 0 |
| Bolam, W. T. | 5 | 0 | 0 |
| Clarke, D. | 2 | 2 | 0 |
| Gotto, F. E. | 2 | 2 | 0 |
| Harding, E. E. | 2 | 2 | 0 |
| Harding, W. D., Jun. | 2 | 2 | 0 |
| Heath, W. H. | 3 | 3 | 0 |
| Marriott, G. W. | 3 | 3 | 0 |
| Martin, J. M. | 3 | 3 | 0 |
| Mason, W. L. | 3 | 3 | 0 |
| Stenning, A. R. | 3 | 3 | 0 |
| Tootell, J. | 2 | 2 | 0 |
| Tootell, R. W. | 2 | 2 | 0 |
| Vigers, A. | 3 | 3 | 0 |

# LIST OF DONATIONS AND CONTRIBUTIONS TO JUNE 1ST, 1878.

## DONATIONS OF BOOKS, MAPS, &c.

| DONORS. | TITLE OF WORK. |
|---|---|
| *Agricultural Gazette*, Editor of the | "The Agricultural Gazette," 1877-78. |
| *Architect*, Editor of the | "The Architect," 1877-78. |
| *Builder*, Editor of the | "The Builder," 1877-78. |
| *Builder's Weekly Reporter*, Editor of the | "The Builder's Weekly Reporter," 1877-78. |
| *Building News*, Editor of the | "The Building News," 1877-78. |
| Denton, J. B. | "A Series of Lectures given before the School of Military Engineering at Chatham, on Sanitary Engineering." By J. B. Denton. |
| Estate Exchange, Committee of the | Index to the "Estate Exchange Registers," 1877-78. |
| Farmers' Club, The | "Journal," 1877-78. |
| *Field*, Editor of the | "The Field," 1877-78. |
| Fowler, W. | "An Account of the mode of Draining Land according to the System practised by Mr. Joseph Elkington." By J. Johnstone. |
| Gouthwaite, R. | "Notes of Proceedings in Parliament in connection with the Leeds and Selby Railway Bill, 1830."<br>Bradshaw's "Railway Companion," 1841. |
| Grantham, R. B. | "Report of the Select Committee on Thames Floods Prevention; together with the Proceedings of the Committee, Minutes of Evidence, and Appendix."<br>"Report of the Select Committee of the House of Lords on Conservancy Boards, &c.; together with the Proceedings of the Committee, Minutes of Evidence, and Appendix." |
| *Horticulture, Journal of*, Editor of the | "The Journal of Horticulture," 1877-78. |
| Institution of Civil Engineers | "Minutes of Proceedings." Vols. XLVIII., XLIX., L., and LI. |
| Institution of Mechanical Engineers | "Proceedings," 1877-78. |

| Donors. | Title of Work. |
|---|---|
| Liverpool Architectural Society | "Proceedings," Thirteenth Session; 4th, 5th, 6th, and 7th Meetings. |
| London and Middlesex Archæological Society | "The History of the Parish of South Mimms." By F. C. Cass. |
| North of England Institute of Mining and Mechanical Engineers | "Transactions." Vol. XXVI., 1876-77. |
| Penfold, J. W. | "The History of Windsor and its Neighbourhood." By J. Hakewill. |
| Robinson, H., and Melliss, J. C. | "Purification of Water-carried Sewage. Data for the guidance of Corporations, Local Boards of Health, and Sanitary Authorities." By H. Robinson and J. C. Melliss." |
| Royal Agricultural Society of England | "Journal." Vol. XII., part 2; vol. XIII., parts 1 and 2; and vol. XIV., part 1. |
| Royal Institute of British Architects | "Transactions." Session 1877-78. |
| Rushworth, E. W. | "A Treatise on the Law and Practice relating to Vendors and Purchasers of Real Estate." By J. H. Dart. |
| Statistical Society | "Journal." Vol. XL., parts 2, 3, and 4. |
| Vigers, L. R. | "A Treatise on the Power and Duty of an Arbitrator, and the Law of Submission and Awards; with an Appendix of Forms, and of the Statutes relating to Arbitration." Fifth Edition, 1878. By F. Russell. |
| Ware, J. O. | "Concrete: its use in Building, and the construction of Concrete Walls, Floors, &c." By T. Potter. |
| Webster, R. E | "Philosophical Transactions of the Royal Society of London" for the years 1853-69; 17 vols. |
| Woodthorpe, E. | "The Railways of Great Britain and Ireland practically described and illustrated." By F. Wishaw.<br>"Historical Account of the Navigable Rivers, Canals, and Railways throughout Great Britain." By J. Priestley. |

# INSTITUTION OF SURVEYORS.

List of Members, June 1st, 1878, with Council for Session 1878-79.

## Honorary Members.

| *Date of Election and of Transfer.* | | |
|---|---|---|
| 1874, Apr. 13 | BEDFORD, HIS GRACE THE DUKE OF | 81 & 82, Eaton Square, S.W. |
| 1875, Mar. 15 | CAIRD, JAMES, C.B. . . . | Tithe and Inclosure Commission Office, St. James's Square. |
| 1877, Jan. 15 | CONSTABLE, JOHN, The REV. . . | The Agricultural College, Cirencester. |
| 1871, Jan. 30 | GORE, CHARLES ALEXANDER, The HONORABLE . . . . . | Office of Woods, &c., 1, Whitehall Place. |
| 1871, Jan. 30 | HOWARD, JAMES KENNETH, The HONORABLE . . . . . | Office of Woods, &c., 1, Whitehall Place. |
| A. '69, Jul. 26 / H.M.'71, Feb. 27 | LEACH, GEORGE ARCHIBALD, LIEUT.-COLONEL . . . | Tithe and Inclosure Commission Office, St. James's Square. |
| A. '68, Jun. 23 / H.M.'77, May 14 | LLOYD, JOHN HORATIO . . . | 100, Lancaster Gate, W. |
| A. '72, Jan. 15 / H.M.'72, Apr. 22 | RIDLEY, GEORGE . . . | Tithe and Inclosure Commission Office, St. James's Square. |

*The names of those Members and Associates who have paid Life Composition Fees are distinguished thus* *

## Members.

| *Date of Election and of Transfer.* | | |
|---|---|---|
| 1868, Jun. 15 | ADAMS, CHARLES FREDERICK . | Barkway, Herts. |
| 1872, Dec. 9 | APPERLEY, WILLIAM HAVARD . | Hereford. |
| 1869, May 3 | ARDING, CHARLES BENNETT. . | 22, Surry Street, Strand, W.C. |
| 1875, Nov. 8 | AUSTIN, RUSSELL GARDINER . | The Wash, Hertford. |
| 1877, Mar. 12 | BALLS, JAMES MAYHEW . . . | Castle Hedingham, Essex. |
| 1868, Aug. 17 | *BARRY, CHARLES . . . . . | 1, Westminster Chambers, Victoria Street, S.W. |
| 1868, Aug. 8 | BEADEL, FREDERICK. . . . | 97, Gresham Street, E.C. |
| 1868, Jun. 15 | BEADEL, WILLIAM JAMES . . *(Vice-President)* | 97, Gresham Street, E.C. |
| 1868, Nov. 2 | *BEAUMONT, GEORGE, JUN. . . | East Bridgford, near Nottingham. |

| *Date of Election and of Transfer.* | MEMBERS. | |
|---|---|---|
| 1876, Apr. 24 | BECKETT, WILLIAM . . . . | Oulton Park Farm, near Tarporley, Cheshire. |
| 1873, Dec. 8 | BEESTON, FREDERICK . . . | 16, Walbrook, E.C. |
| 1875, Mar. 1 | BENNETT, THOMAS OATLEY, JUN. | Bruton, Somerset. |
| 1873, Feb. 24 | BEWICK, THOMAS JOHN . . . | 4, Broad Sanctuary, S.W. |
| 1869, Mar. 22 | BIDWELL, CHARLES . . . . | Ely, Cambridgeshire. |
| 1875, Apr. 12 | BINGHAM, REUBEN . . . . | 5, Bolton Street, Piccadilly. |
| 1868, Oct. 26 | BINNIE, THOMAS . . . . . *(Member of Council)* | 207, Hope Street, Glasgow. |
| 1868, Aug. 10 | BIRD, JAMES BINFIELD . . . | West Cowes, Isle of Wight. |
| 1870, Feb. 7 | BLOUNT, WILLIAM . . . . | Orchehill House, Gerard's Cross, Bucks. |
| 1874, Feb. 2 | BOLAM, CHARLES GODFREY . . | Savernake Forest, Wiltshire. |
| 1874, Feb. 2 | BOLAM, HARRY GEORGE . . . | Ingestre, Stafford. |
| 1876, May 8 | BOLAM, WILLIAM THOMAS . . | Newcastle-upon-Tyne. |
| 1875, Dec. 13 | *BOLDEN, JOHN LEONARD . . | Tehidy Office, Camborne, Cornwall. |
| 1869, May 3 | BOND, ERASMUS . . . . . | 22, Surry Street, Strand, W.C. |
| 1868, Jun. 15 | BONNY, JAMES RIPPOTH . . . | 47, Old Broad Street, E.C. |
| 1868, Jul. 13 | BOWLER, WILLIAM ANTHONY . | Craven Chambers, Craven Street, W.C. |
| 1874, Dec. 7 | BROOK, JAMES . . . . . | 28, John William Street; and Spring Wood, New Mill, Huddersfield. |
| 1874, Dec. 7 | BROUGHTON, JOHN . . . . | South Shields, Durham. |
| 1874, Jan. 5 | BROWN, DANIEL JOHNSON . . | 61, Lincoln's Inn Fields, W.C. |
| 1868, Jul. 13 | BROWN, GEORGE . . . . . | Roborough House, Barnstaple, Devonshire. |
| 1871, Dec. 18 | BROWN, JOHN. . . . . | Rose Hill, Chesterfield. |
| 1869, Feb. 22 | BROWN, THOMAS FORSTER . . | Guildhall Chambers, Cardiff. |
| 1869, Feb. 8 | BROWN, WILLIAM. . . . . | Tring, Herts. |
| 1874, Apr. 13 | BRYANT, ARTHUR JOHN . . . | 3, Old Palace Yard, Westminster, S.W. |
| 1870, Dec. 12 | BUCHAN, THOMAS. . . . . | 24, Bank Street, Dundee. |
| 1868, Jul. 13 | BUCK, ALBERT . . . . . | Worcester. |
| 1871, Dec. 18 | BUCKLAND, FRANK BOWRY . . | Windsor. |
| 1868, Jun. 15 | BUCKLAND, VIRGOE . . . . *(Member of Council)* | 66, Cannon Street, E.C. |
| 1868, Jul. 20 | BURNELL, EDWARD HENRY . . | 32, Bedford Row, W.C. |
| 1875, Feb. 1 | *BURROUGHES, THOMAS HENRY. | Ketton, Rutlandshire. |
| A. '68, Aug. 10<br>M. '75, Mar. 15 | BUTLER, ARTHUR . . . . | 7, Staple Inn, W.C. |
| 1874, Jan. 5 | BUZZARD, ALFRED LINDSEY. . | 22, Surry Street, Strand, W.C. |
| 1869, Jul. 12 | CADLE, CLEMENT . . . . . | Clarence Street, Gloucester. |
| 1876, Apr. 24 | CASSELL, JAMES ROBERT . . | 11, Billiter Square, E.C. |
| 1874, Jan. 19 | CASTLE, HENRY JAMES, SEN. . | 5, Chancery Lane, W.C. |
| 1873, Jan. 13 | CASTLE, ROBERT . . . . . | Merton Street, Oxford. |
| 1872, Mar. 11 | CASTLE, WILLIAM HENRY BALDWIN | 5, Chancery Lane, W.C. |
| 1870, Dec. 12 | CATES, ARTHUR . . . . . | 7, Whitehall Yard, S.W. |
| 1875, Jan. 4 | CAVE, HENRY H. . . . | Brigg, Lincolnshire. |
| 1870, Jan. 10 | CHANCELLOR, FREDERICK . . | Chelmsford. Essex; and 8, Finsbury Circus, E.C. |
| 1868, Jun. 15 | CHAPMAN, GEORGE . . . . | 14, Cockspur Street, S.W. |

| *Date of Election and of Transfer.* | MEMBERS. | |
|---|---|---|
| 1873, Jan. 27 | CHEFFINS, CHARLES RICHARD . | 23, Abingdon Street, S.W. |
| 1868, Jul. 6 | CHINNOCK, FREDERICK GEORGE | 11, Waterloo Place, S.W. |
| 1868, Jun. 15 | CLARKE, THOMAS CHATFEILD . (*Member of Council*) | 63, Bishopsgate Street Within, E.C. |
| 1868, Jun. 15 | CLIFTON, EDWARD NORTON . . (*Past-President*) | 7, East India Avenue, E.C. |
| 1868, Jun. 15 | CLUTTON, HENRY . . . . | 9, Whitehall Place, S.W. |
| 1868, Jun. 15 | CLUTTON, JOHN . . . . . (*Past-President*) | 9, Whitehall Place, S.W. |
| '68, Jul. 13 } '75, May 10 } | CLUTTON, JOHN HENRY . . . | 9, Whitehall Place, S.W. |
| '68, Jul. 6 } '74, Apr. 13 } | CLUTTON, RALPH . . . . . | 9, Whitehall Place, S.W. |
| '70, Jan. 10 } '75, Dec. 13 } | CLUTTON, RALPH WILLIAM . . | Hartswood, Reigate, Surrey. |
| 1868, Jul. 13 | CLUTTON, ROBERT GEORGE . . | 9, Whitehall Place, S.W. |
| 1869, Jan. 11 | CLUTTON, WILLIAM JAMES . . | The Mount, York. |
| 1868, Jun. 15 | COBB, ROBERT LAKE. . . . | Higham, Kent. |
| 1868, Jul. 20 | COLLIER, JOHN . . . . . | Salters' Hall, St. Swithin's Lane, E.C. |
| 1868, Aug. 17 | COLLINS, HENRY HYMAN . . | 61, Old Broad Street, E.C. |
| 1869, Apr. 5 | COMELY, JOHN GILL . . . . | Winchester, Hants. |
| 1876, Apr. 24 | COOTE, GEORGE . . . . . | Smeetham Hall, Sudbury, Suffolk. |
| 1872, Jan. 29 | COUCHMAN, CHARLES. . . . | 6, Waterloo Street, Birmingham. |
| 1878, Jan. 28 | COWGILL, WILLIAM . . . . | Bradford. |
| 1868, Jun. 15 | CRAWTER, HENRY . . . . . | 5, Bedford Row, W.C. |
| 1869, Jan. 25 | CRAWTER, JOHN . . . . . | Cheshunt, Herts. |
| 1869, Jan. 25 | CRICKMAY, GEORGE RACKSTROW. | St. Thomas Street, Weymouth. |
| 1874, May 11 | CRONK, EDWYN EVANS . . . | Sevenoaks, Kent. |
| 1876, Jan. 10 | CROSS, JOHN . . . . . | Cross Street Chambers, Manchester. |
| 1873, Apr. 21 | CROSS, WILLIAM STEPHENS . | 53, Charing Cross, S.W. |
| 1868, Jun. 15 | CURREY, HENRY . . . . . | 37, Norfolk Street, W.C. |
| 1877, Apr. 16 | CURTIS, ROBERT LEABON . . | 15 and 16, Blomfield Street, E.C. |
| 1878, Apr. 29 | DARLEY, WILLIAM . . . . | Castle Eden, Durham. |
| 1868, Jul. 13 | DAVID, EDWARD . . . . . | Llandaff, Glamorganshire. |
| 1868, Nov. 2 | DAVIDS, CHARLES HENRY . . | Banbury, Oxfordshire. |
| 1873, Feb. 10 | DAVIES, JOHN MORGAN . . . | Froodvale, Llandilo, Carmarthenshire. |
| 1868, Jun. 15 | DENT, JOHN . . . . . | 34, Great James Street, W.C. |
| 1868, Jun. 15 | DENTON, JOHN BAILEY . . . | 22, Whitehall Place, S.W. |
| 1869, Feb. 8 } 1878, Feb. 25 } | DODGSON, WILFRED LONGLEY . | The Moor, Ludlow. |
| 1878, Jan. 14 | DOWNING, FREDERICK . . . | 7A, Whitehall Yard, S.W. |
| 1868, Nov. 9 | DOWNS, HENRY . . . . . | Basingstoke, Hants. |
| 1873, Feb. 10 | DREW, HENRY . . . . . | Exeter. |
| 1872, Feb. 26 | DREW, JOHN . . . . . | 9, Queen Street, Exeter; and Powderham Castle, near Exeter. |

| *Date of Election and of Transfer.* | MEMBERS. | |
|---|---|---|
| 1868, Jun. 15 | DRIVER, ROBERT COLLIER . . *(Member of Council)* | 4, Whitehall, S.W. |
| A. 1876, Jan. 10 M. 1878, Feb. 25 | DRIVER, CHARLES WILLIAM . | 4, Whitehall, S.W. |
| 1874, Jan. 5 | DUNCH, CHARLES. . . . . | District Board Offices, White House, Commerci Road, E. |
| 1871, Jan. 30 | DUNLOP, ALEXANDER MILNE . | 3, Old Palace Yard, Westminster, S.W. |
| 1868, Jun. 15 | DYMOND, FRANCIS WILLIAMS . | Exeter. |
| 1868, Aug. 3 | EASTON, WILLIAM . . . . | 6, Hammet Street, Taunton, Somersetshire. |
| 1868, Aug. 3 | EILOART, FERDINAND . . . | 40, Chancery Lane, W.C. |
| 1875, Feb. 1 | ELLIS, JOHN WHITTAKER, (Alderman) . . . . . | 5, Lancaster Place, W.C., and 18, Old Bros Street, E.C. |
| 1872, Feb. 26 | EMMANUEL, BARROW . . . . | 2, Finsbury Circus, E.C. |
| A. 1874, Feb. 16 M. 1876, Nov. 27 | EVANS, WILLIAM ERNEST . . | The Priory, Shrewsbury. |
| 1868, Aug. 3 | EVE, WILLIAM . . . . . | 10, Union Court, Old Broad Street, E.C. |
| 1873, May 5 | EVES, GEORGE . . . . . | Uxbridge, Middlesex. |
| 1869, Jul. 26 | FELTON, GEORGE . . . . | Llandudno, Carnarvon. |
| 1873, Jan. 27 | FIELD, FRANCIS HAYWARD . . | Merton Street, Oxford. |
| 1872, Mar. 11 | FOSTER, CHARLES ROLLS . . | 54, Pall Mall, S.W. |
| 1873, Dec. 8 | FOWLER, WILLIAM . . . . | 23, Waterloo Street, Birmingham. |
| 1874, Jan. 5 | FOX, FREDERICK FRANCIS . . | Melbourne, near Derby. |
| 1875, Jan. 18 | FRY, GEORGE FREDERICK . . | 5, Tavistock Street, Covent Garden, W.C. |
| 1868, Jun. 15 | FULLER, FRANCIS. . . . . | 8, Northumberland Avenue, S.W. |
| 1876, Jan. 10 | GAIRDNER, EDWARD JAMES . . | 42, University Street, W.C. |
| 1868, Jul. 6 | GALSWORTHY, FREDERICK THOMAS | 11, Waterloo Place, S.W. |
| 1868, Sep. 28 | GARDINER, WILLIAM JAMES . . | 110, Great Russell Street, W.C. |
| 1877, Feb. 12 | GERMAN, WILLIAM . . . . | Measham, Atherstone, Derbyshire. |
| 1875, Feb. 1 | GILBERT, WILLIAM HENRY SAINSBURY . . . . . | Wool Exchange, Coleman Street, E.C. |
| 1869, Dec. 6 | GIRDWOOD, JAMES . . . . | 49, Pall Mall, S.W. |
| 1876, Jan. 24 | GLASIER, GEORGE HENRY BROUGHAM . . . . | 41, Charing Cross, S.W. |
| A. 1873, May 19 M. 1878, Mar. 11 | GORE, SPENCER W. . . . . | 16, Whitehall Place, S.W. |
| 1873, Feb. 10 | GOUTHWAITE, RICHARD . . . | Lumby, near South Milford, Yorkshire. |
| 1875, Jan. 10 | GRAHAM, WILLIAM . . . . | Victoria Chambers, Newport, Monmouthshire. |
| 1875, Jan. 18 | GREY, CHARLES GREY . . . | 55, Parliament Street, Westminster, S.W. |
| 1876, Mar. 28 | GWYTHER, WILLIAM WARLOW . | 12, Beaufort Buildings, Strand, W.C. |
| 1874, Mar. 16 | HADDOCK, ROLAND . . . . | 21, High Street, Croydon, Surrey. |
| 1868, Jul. 13 | HALL, RICHARD . . . . . | 37, Great George Street, S.W. |
| 1868, Aug. 3 | HALL, ROBERT WRIGHT . . . | 37, Great George Street, S.W. |

| *of Election of Transfer.* | MEMBERS. | |
|---|---|---|
| 1875, Jan. 4 | HARDING, JOSEPH . . . . | 49, Lune Street, Preston. |
| 1875, Dec. 17 | HARDING, WILLIAM DANIEL . . | 16, St. Paul's Churchyard, E.C. |
| 1871, Feb. 23 | HART, WILLIAM FREDERICK . | 175, Kennington Park Road, S.E. |
| 1868, Jul. 13 | HARVEY, JOHN . . . . . | 6, Victoria Place, Haverfordwest, Pembrokeshire. |
| 1868, Jul. 13 | HARVEY, RICHARD HART . . | 6, Victoria Place, Haverfordwest, Pembrokeshire. |
| 1873, May 19 | HASLAM, DRYLAND . . . . | 17, Friar Street, Reading. |
| 1868, Jul. 6 | *HAYWOOD, WILLIAM . . . . | Guildhall, London, E.C. |
| 1877, Apr. 30 | HEATH, WILLIAM HENRY . . | 181, Bishopsgate Street Without, E.C. |
| 1871, Jan. 16 | HEDLEY, THOMAS FENWICK . . | Sunderland. |
| 1870, Jan. 10 | HILLIARD, GEORGE BRIDGE . | Chelmsford, Essex. |
| 1868, Jul. 13 | HIPPISLEY, EDWIN . . . . | Chamberlain Street, Wells, Somersetshire. |
| 1874, Nov. 16 | HOLDEN, ISAAC . . . . . | 64, Cross Street, Manchester. |
| 1874, Nov. 16 | HOLDEN, JOHN . . . . . | 64, Cross Street, Manchester. |
| 1868, Jun. 15 | HORSEY, THOMAS . . . . | 11, Billiter Square, E.C. |
| 1869, Feb. 22 | HORSFALL, RICHARD . . . . | Halifax, Yorkshire. |
| 1869, Apr. 5 | HORWOOD, JAMES. . . . . | 10, Paternoster Row, E.C. |
| 1868, Sep. 28 | HUDSON, WILLIAM . . . . | 19, Bennet's Hill, E.C. |
| 1868, Nov. 2 | HUMBERT, CHARLES F. . . . | Watford, Herts. |
| 1869, Feb. 22 | HUMPHREYS, CHARLES . . . | 61, Leadenhall Street, E.C. |
| 1868, Jun. 15 | HUNT, SIR HENRY ARTHUR, C.B. | 45, Parliament Street, Westminster, S.W. |
| 1874, May 11 | HUNT, HENRY ARTHUR, JUN. . | 3, Victoria Street, Westminster, S.W. |
| 1869, Mar. 8 | HUNT, JOSIAH . . . . . | 6, Queen Anne's Gate, Westminster, S.W. |
| 1868, Jun. 15 | HUSKINSON, THOMAS . . . *(Past-President)* | Epperstone, Nottingham. |
| 1874, Jan. 19 | HUSKINSON, WILLIAM LAMBE . | The Manor House, Epperstone, Nottingham. |
| 1869. Feb. 22 | HUSSEY, GEORGE HENRY . . | The Green, High Wycombe, Bucks. |
| 1868, Jun. 15 | I'ANSON, EDWARD . . . . *(Vice-President)* | 7A, Laurence Pountney Hill, E.C. |
| 1869, Jul. 26 | JACKSON, FREDERICK. . . . | Nottingham. |
| 1876, Apr. 3 | JEMMETT, ALEXANDER . . . | Murrell Hill Farm, Binfield, Bracknell, Berks. |
| 1869, Apr. 5 / 1878, Feb. 25 | JONAS, HENRY . . . . . | 4, Whitehall, S.W. |
| 1868, Jul. 27 | JONAS, JOHN CARTER . . . | 27, Market Hill, Cambridge. |
| 1873, Apr. 21 | JONES, HENRY PARR . . . | Portway House, Warminster. |
| 1869, Mar. 22 | KING, WILLIAM DAVID . . . | Farlington Farm, Havant, Hants. |
| 1868, Sep. 28 | KNOLLYS, JAMES EDWARD . . | Fitzhead Court, Taunton, Somerset. |
| 1871, Feb. 27 | KNOWLES, WILLIAM . . . . | Albion Chambers, King Street, Gloucester. |
| 1868, Aug. 3 | LAMBERT, WILLIAM . . . . | 4, New Basinghall Street, E.C. |
| 1876, Apr. 24 | LANE, CECIL NEWTON . . . | King's Bromley Manor, Lichfield. |
| 1868, Nov. 9 | LAURANCE, JOHN, JUN. . . . | Warmington, near Oundle, Northamptonshire. |
| 1868, Jul. 20 | LAVENDER, JOSEPH . . . . | 26, Bedford Row, W.C. |

| *Date of Election and of Transfer.* | MEMBERS. | |
|---|---|---|
| 1868, Jun. 15 | LEE, CHARLES | 8, Adelphi Terrace, W.C. |
| 1874, Feb. 2 | LEE, FREDERICK | 6, Great College Street, Westminster, S.W. |
| 1878, Mar. 25 | LEE, WILLIAM WARD | 33, Finsbury Circus, E.C. |
| 1870, Feb. 7 | LEES, JOHN | Reigate, Surrey. |
| 1875, Jan. 18 | LLEWELLIN, DAVID | Pontypool, Monmouthshire. |
| 1875, Mar. 15 | LOFTS, HENRY | 99, Mount Street, Grosvenor Square, W. |
| 1876, Feb. 7 | LOVEJOY, ALFRED | 25, Queen Anne's Gate, Westminster, S.W. |
| 1868, Aug. 3 | LOVEJOY, WILLIAM | 55, Chancery Lane, W.C. |
| 1869, Jul. 12 | LYE, JOHN GAUNT | 8, Lancaster Place, W.C. |
| 1868, Nov. 2 | MACAULAY, COLIN ALEXANDER | Leicester. |
| 1869, Jan. 25 | MANN, CHARLES JOHN | 29, Great George Street, S.W. |
| 1875, Jan. 18 | MANN, ROBERT WILKS | 7, Hobart Place, S.W.; and White Hall, Hay |
| 1869, Mar. 29 | MARR, JAMES | 8, Adam Street, Adelphi, W.C. |
| 1876, Mar. 20 | *MARTIN, GILSON | Tavistock. |
| 1875, Jan. 4 | MARTIN, HOWARD | 145, High St., Croydon; & The Ferns, E. Croyd |
| 1870, Feb. 7 | *MARTIN, JAMES *(Member of Council)* | Wainfleet, Boston, Lincolnshire. |
| 1876, May 8 | MARTIN, JOHN MAY | Lower Musgrave House, Exeter. |
| 1875, May 10 | MASON, WILLIAM LUDLAM | Louth, Lincolnshire. |
| 1868, Jun. 15 | MATHEWS, JEREMIAH | 15, Waterloo Street, Birmingham. |
| 1868, Jun. 15 | *MATHEWS, WILLIAM | 15, Waterloo Street, Birmingham. |
| 1876, Feb. 7 | MCCALL, GEORGE | 4, Station Road, Blackburn. |
| 1877, Feb. 12 | MINTER, WILLIAM | 81, Bondgate, Darlington. |
| 1874, Dec. 7 | MOORE, EDWARD WELLS | Middle Claydon, Winslow. |
| 1876, Nov. 13 | MORRIS, JOHN WARRINGTON | Gracechurch Buildings, Gracechurch Street, E |
| 1874, Apr. 13 | NAYLOR, ARTHUR MILLINGTON | 3, Old Palace Yard, Westminster, S.W. |
| 1868, Nov. 2 | NEALE, CHARLES JAMES | High Oakham, Mansfield, Notts. |
| 1872, Dec. 9 | NEWMAN, FRANCIS | Ryde, Isle of Wight. |
| 1875, Jan. 18 | NICHOLS, DANIEL CUBITT | 7, Howard Street, Strand, W.C. |
| 1872, Jan. 29 | NISBET, RALPH P. | Clarendon Chambers, 26 & 27, Villiers St., Stra |
| 1873, Apr. 21 | NOBLE, JOHN | Woodhall, Herts. |
| 1875, Apr. 26 | NOCKOLDS, MARTIN | Saffron Walden, Essex. |
| 1876, Mar. 20 | NORMAN, JAMES MAURICE | Uxbridge, Middlesex. |
| 1869, Mar. 8 | NORMAN, WILLIAM | 8, Spring Gardens, S.W. |
| 1868, Jul. 20 | NORTH, GEORGE | 22, Whitehall Place, S.W. |
| 1871, Feb. 13 | NOTLEY, RICHARD ALBERT | 80, Cornhill, E.C. |
| 1868, Jul. 6 | *OAKLEY, CHRISTOPHER | 10, Waterloo Place, S.W. |
| 1877, Apr. 30 | OAKLEY, WILLIAM | 29, Charles Street, St. James's Square, S.W. |
| 1869, Mar. 8 | OWEN, THOMAS RULE | High Street, Haverfordwest, Pembrokeshire. |
| 1872, Dec. 9 | PARSONS, HENRY | Haslebury Plucknett, Crewkerne, Somerset. |
| 1875, Nov. 8 | PATERSON, ROBERT | 10, Hanover Street, Edinburgh. |

| *of Election f Transfer.* | MEMBERS. | |
|---|---|---|
| '70, Dec. 12 | PAXTON, JONAS . . . . . | Bicester, Oxfordshire. |
| '68, Jun. 15 | PENFOLD, JOHN WORNHAM . . (*Honorary Secretary*) | 29, Great George Street, Westminster, S.W. |
| '76, May 8 | PEPPERCORN, JOHN HUTCHINSON | Eaton Socon, Bedfordshire. |
| '76, Feb. 21 | PHILLIPS, FREDERICK HAMILTON | Newtown, Montgomeryshire. |
| '73, Dec. 8 | PINK, CHARLES . . . . . | Winchester, Hants. |
| '70, Jan. 24 | POUNDLEY, JOHN EDWARD . . | Black Hall, Kerry, Montgomeryshire. |
| '77, May 14 | POWELL, EVAN . . . . . | Broomcliffe, Llanidloes. |
| '77, Dec. 10 | POWNALL, GEORGE HARRY . . | 29, Parliament Street, S.W. |
| '72, Nov. 25 | PRICKETT, WALTER BELLSON . | 62, Chancery Lane, W.C. |
| '77, May 14 | PRIOR, RICHARD JAMES . . . | Canterbury, and 61, Lincoln's Inn Fields, W.C. |
| '70, Jan. 24 | RAWLENCE, GEORGE . . . . | Salisbury, Wilts. |
| '70, Feb. 7 | RAWLENCE, JAMES . . . . | Salisbury, Wilts. |
| '68, Oct. 26 | RAYNBIRD, HUGH EDWARD . . | Basingstoke, Hants. |
| '76, Dec. 18 | RICHARDSON, JOHN . . . . | Methley Park, Leeds. |
| '73, Feb. 10 | RICKMAN, THOMAS MILLER . . | 8, Montague Street, Russell Square, W.C. |
| '68, Jun. 15 | RIGDEN, RICHARD HENRY . . | The Close, Salisbury, Wilts. |
| '68, Aug. 17 | ROBERTS, RICHARD . . . . | 25, Laurence Pountney Lane, E.C. |
| '68, Jul. 13 | ROBINS, EDWARD COOKWORTHY . | 14, John Street, Adelphi, W.C. |
| '72, Dec. 9 | *ROBSON, EDWARD ROBERT . . | 41, Parliament Street, Westminster; and 6, St. Germain's Place, Blackheath, S.E. |
| '4, Dec. 7. '6, Jan. 24. | ROLLESTON, JOHN FOWKE LANCELOT . . . . | Grey Friars, Leicester. |
| '68, Aug. 31 | ROSSER, WILLIAM . . . . | Llanelly, Carmarthen. |
| '78, Apr. 8 | ROWE, RICHARD REYNOLDS . . | 10, Emmanuel Street, Cambridge. |
| '70, Feb. 21 | RUSHWORTH, EDMUND . . . | 22, Savile Row, W. |
| '3, Dec. 8. '5, Nov. 8. | RUSHWORTH, EDMUND WALTER | 22, Savile Row, W. |
| '68, Jun. 15 | RYDE, EDWARD . . . . (*Vice-President*) | 29, Great George Street, S.W. |
| '76, Jan. 24 | SADLER, GEORGE WILLIAM . . | 467, High Street, Cheltenham. |
| '75, Apr. 26 | SANDAY, GEORGE HENRY . . | Wensley House, Bedale, Yorkshire. |
| '76, Nov. 27 | SANDY, HENRY . . . . . | Newport Road, Stafford. |
| '69, Feb. 8 | SAUNDERS, CECIL GEORGE . . | 29, Great George Street, S.W. |
| '69, Feb. 22 | SAUNDERS, EDWARD . . . . | 6, Bishopsgate Street Without, E.C. |
| '68, Aug. 17 | SAVILL, ALFRED . . . . . | 3, St. Helen's Place, E.C.; and Chigwell, Essex. |
| '74, Feb. 2 | SCARTH, WILLIAM . . . . (*Member of Council*) | Raby Castle, Darlington. |
| '69, Mar. 8 | SCOTT, THOMAS COLVILLE . . | 19, King's Arms Yard, E.C. |
| '75, Mar. 1 | SEARLE, FRANCIS WILLIAM . . | Marsh House, Tottenham, Middlesex. |
| '71, Jan. 16 | SEDGWICK, ALFRED OWTHWAITE (*Member of Council*) | Watford, Herts; and 49, Bedford Row, W.C. |
| '75, Mar. 1 | SHACKEL, GEORGE . . . . | 12, The Forbury, Reading, Berks. |
| '76, Mar. 6 | SHAW, JOHN . . . . . | College Place, Derby. |
| '68, Jul. 13 | SHOPPEE, CHARLES JOHN . . (*Member of Council*) | 61, Doughty Street, W.C. |

| *Date of Election and of Transfer.* | MEMBERS. | |
|---|---|---|
| 1875, Apr. 26 | Simonds, John Cabourn . . | Fishloft Manor, Boston, Lincolnshire. |
| 1872, Apr. 22 | Slater, George. . . . . | Canterbury. |
| 1868, Oct. 26 | Smellie, Thomas Davies . . | 209, St. Vincent Street, Glasgow. |
| 1863, Aug. 17 | Smith, Charles Bovill . . | Wickham, Hants. |
| 1868, Jul. 13 | Smith, Charles John . . . | 10, Waterloo Place, S.W. |
| A. '70, Mar. 21 / M. '78, Mar. 11 | Smith, Charles John . . . | 16, Whitehall Place, S.W. |
| 1868, Jun. 15 | Smith, Edmund James . . . (*Past-President*) | 16, Whitehall Place, S.W. |
| 1872, Feb. 26 | Smith, Thomas Tayler . . | 33, Bloomsbury Square, W.C. |
| 1868, Aug. 10 | Snooke, William . . . . | 6, Duke Street, London Bridge, S.E. |
| 1868, Nov. 9 | Southwell, Charles Josiah . | 9, Whitehall Place, S.W. |
| 1868, Jul. 27 | Spackman, Henry . . . . | 6, Terrace Walks, Bath. |
| 1868, Jun. 15 | Squarey, Elias Pitts . . . (*Member of Council*) | 22, Great George Street, S.W.; and The Moo Downton, Salisbury. |
| 1871, Feb. 13 | St. Quintin, Perry. . . . | 37, Threadneedle Street, E.C. |
| 1868, Aug. 17 | Stanley, Henry . . . . | Bury St. Edmunds, Suffolk. |
| 1868, Jun. 15 | Statter, Thomas . . . . | Standhall, Whitefield, Manchester. |
| 1877, Jan. 15 | Stenning, Alexander Rose . | 27, Fenchurch Street, E.C. |
| 1868, Jun. 15 | Stephenson, Charles . . . (*Member of Council*) | 45, Parliament Street, Westminster, S.W. |
| 1876, Jan. 24 | Stephenson, Christopher. . | Woburn, Bedfordshire. |
| 1868, Jul. 27 | Steward, Herbert Thomas . | 3, Victoria Street, S.W. |
| 1868, Jul. 20 | Sturge, Robert Fowler . . | 34, Corn Street, Bristol. |
| 1868, Jun. 15 | Sturge, William . . . . (*President*) | 34, Corn Street, Bristol. |
| 1874, Feb. 16 | Sworder, George Edward . | Bishop's Stortford, Herts. |
| 1875, Feb. 15 | Sworder, William . . . . | Stapleford Tawney Hall, near Romford, Essex |
| A. '70, Feb. 7 / M. '78, Jan. 28 | Tatham, George Henry . . | 34, Essex Street, Strand, W.C. |
| 1874, Jan. 19 | Thomas, Josiah . . . . . | Athenæum Chambers, Nicholas Street, Bristol. |
| 1878, Jan. 14 | *Thursfield, Thomas Howells | Barrow, Brosely, Shropshire. |
| 1868, Jun. 15 | Thynne, Edward Lewis . . | 11, Great George Street, S.W. |
| 1869, Jan. 11 | Thynne, Frederick George . | 11, Great George Street, S.W. |
| 1875, Jan. 18 | Tolley, James . . . . . | 66, Cannon Street, E.C. |
| 1877, Jan. 29 | Tootell, Joseph . . . . | Maidstone, Kent. |
| 1877, Jan. 29 | Tootell, Richard William . | 11, Queen Victoria Street, E.C. |
| 1876, Apr. 24 | Tower, Brownlow Richard Christopher . . . . . | Little Ingestre, Stafford. |
| 1868, Jun. 15 | Trist, George . . . . . | 62, Old Broad Street, E.C. |
| 1874, May 11 | Trollope, Charles Brown . | 13, Parliament Street, Westminster, S.W. |
| 1868, Jun. 15 | Trumper, Richard . . . . | 23, Lincoln's Inn Fields, W.C. |
| 1868, Aug. 3 | Tuckett, Philip Debell . . | 10A, Old Broad Street, E.C. |
| 1869, Feb. 8 | Turner, William . . . . | 1, Butter Market, Ipswich, Suffolk. |
| 1876, Feb. 21 | Vernon, Arthur . . . . | Borshams, High Wycombe, Bucks. |
| 1876, Jan. 20 | Vigers, Astley . . . . . | 4, Frederick's Place, E.C. |

| *Date of Election and of Transfer.* | MEMBERS. | |
|---|---|---|
| 1871, Dec. 4 | VIGERS, EDWARD, JUN. . . . | 15, Parliament Street, Westminster, S.W. |
| 1868, Jun. 15 | VIGERS, FRANCIS . . . . . (*Member of Council*) | 4, Frederick's Place, E.C. |
| 1868, Jun. 15 | VIGERS, ROBERT . . . . . | 4, Frederick's Place, E.C. |
| 1872, Dec. 9 | VULLIAMY, GEORGE . . . . | Metropolitan Board of Works, Spring Gardens, S.W. |
| 1869, Jan. 25 | WARING, THOMAS . . . . | 21, Queen Street, Cardiff. |
| '69, Mar. 8. '75, Apr. 12. | WARNER, WILLIAM HENRY . . | 99, Mount Street, Grosvenor Square, W. |
| 1868, Jun. 15 | WATNEY, DANIEL. . . . . (*Member of Council*) | 62, Old Broad Street, E.C. |
| 1872, May 6 | WEALL, JOHN, JUN. . . . . | Rugby House, Pinner, Middlesex. |
| 1869, Dec. 6 | WEBB, GEORGE . . . . . | Tunstall, Sittingbourne, Kent. |
| 1868, Jul. 20 | WESTBURY, GILES . . . . | Andover, Hants. |
| 1868, Nov. 9 | WHICHCORD, JOHN . . . . | 12, Queen Victoria Street, Mansion House, E.C. |
| 1874, Apr. 27 | WIDNELL, FREDERICK GRAINGER | 13, Parliament Street, Westminster, S.W. |
| 1870, Feb. 7 1876, Nov. 13 | *WIGRAM, JOHN . . . . . | South Collingham, Newark, Notts. |
| 1868, Jul. 20 | WILLIAMS, GEORGE BARNES . | Frederick's Place, E.C. |
| 1870, May 9 | WILLIAMS, STEPHEN WILLIAM . | Rhayader, Radnorshire. |
| 1876, Mar. 6 | WILLIAMSON, FRANCIS . . . | 31, Castle Gate, Nottingham. |
| 1868, Aug. 10 | WILLMOT, FRANCIS . . . . | 33, Waterloo Street, Birmingham. |
| 1868, Jun. 15 | WITHALL, RICHARD AUGUSTUS . | 29, Great George Street, Westminster, S.W. |
| 1868, Jun. 15 | WOOD, FREDERICK . . . . | Albert House, Rugby, Warwickshire. |
| 1868, Jul. 13 | WOOD, WILLIAM BRYAN . . . | Chippenham, Wilts. |
| 1873, Feb. 10 | WOODCOCK, RICHARD . . . | 20, Darlington Street, Wolverhampton. |
| 1868, Jul. 6 | WOODHOUSE, JOHN THOMAS . | Midland Road, Derby. |
| 1875, Mar. 1 | WOODTHORPE, EDMUND. . . | 2, Coleman Street Buildings, Moorgate St., E.C. |
| 1868, Jun. 15 | WOOLLEY, THOMAS SMITH . . (*Vice-President*) | South Collingham, Newark, Notts. |
| 1871, Nov. 13 1877, Jan. 29 | WOOLLEY, WILLIAM EDWARD . | Loughborough, Leicestershire. |
| 1872, Dec. 9 | WRIGHT, WILLIAM EDWARD . | King's Lynn, Norfolk. |
| 1872, Apr. 22 | *WRIGHT, WILLIAM . . . . | Wollaton, Nottinghamshire. |
| 1876, Feb. 21 | YEOMAN, GEORGE DUNDAS . . | Law's House, Turvey, Bedfordshire. |

## Associates.

| *Date of Election.* | | |
|---|---|---|
| 1876, Mar. 20 | ACLAND, SIR THOMAS DYKE, BART., M.P. . . . . | Killerton, Exeter. |
| 1878, Feb. 11 | AMBROSE, WILLIAM, Q.C. . . | 3, Plowden Buildings, Temple. |

| *Date of Election.* | ASSOCIATES. | |
|---|---|---|
| 1868, Nov. 2 | Badcock, Philip | 9, Whitehall Place, S.W. |
| 1868, Jul. 27 | Barry, John Wolfe | 23, Delahay Street, Westminster, S.W. |
| 1875, Dec. 13 | Batten, John Winterbotham | 3, Harcourt Buildings, Temple. |
| 1876, Dec. 18 | Bazalgette, Charles Norman | 1, Essex Court, Temple. |
| 1868, Nov. 9 | Beauchamp, Charles Davie | 9, Whitehall Place, S.W. |
| 1878, Feb. 11 | Bevan, Walter | 7, High Street, Shrewsbury. |
| 1869, Feb. 22 | Bidder, George Parker, Jun., Q.C. | 3, Paper Buildings, Temple. |
| 1875, Feb. 1 | Bidwell, Shelford | 9, Whitehall Place, S.W. |
| 1875, Feb. 1 | Birch, Robert William Peregrine | 5, Westminster Chambers, S.W. |
| 1875, Feb. 1 | Blakeway, John | 5 and 6, Lancaster Place, Strand, W.C. |
| 1878, May 13 | Blosse, Edward F. Lynch | The Deanery, Llandaff, Glamorganshire. |
| 1868, Jun. 23 | Bramwell, Frederick Joseph | 37, Great George Street, Westminster, S.W. |
| 1870, Dec. 12 | Cardall, Frederic William | 9, Whitehall Place, S.W. |
| 1869, Jul. 26 | Carlisle, William Thomas | 8, New Square, Lincoln's Inn, W.C. |
| 1870, Feb. 7 | Carritt, Ernest | 4, Lime Street Square, Lime Street, E.C. |
| 1871, Feb. 13 | Castle, Edward James | 4, Brick Court, Temple. |
| 1870, May 9 | Catling, Robert Charles | Needham Hall, Elm, Cambridgeshire. |
| 1876, Nov. 13 | Clarke, Daniel | Easton Street, High Wycombe, Bucks. |
| 1876, Feb. 7 | Clayden, Walter | 6, Moorgate Street, E.C. |
| 1874, Jan. 5 | Cooke, William George | 3, Vine Terrace, York Road, S.E. |
| 1876, Dec. 18 | Cox, James Ponsonby, Colonel | 81, Onslow Square, S.W. |
| 1870, Jan. 10 | Crawley, William Jeeves | 10, Waterloo Place, Pall Mall. |
| 1875, Mar. 1 | Cruse, Edmund | Warminster, Wiltshire. |
| 1875, Feb. 15 | Dale, John | 16, Whitehall Place, S.W. |
| 1875, Apr. 26 | Dashwood, Frederick Loftus | Kirtlington, Oxford. |
| 1877, Dec. 10 | Davis, James | 31, Charing Cross, S.W. |
| 1868, Nov. 9 | Dean, Henry, Jun. | Deddington, Oxon. |
| 1869, Jan. 25 | Dowden, Henry Joseph | 4, Whitehall, S.W. |
| 1869, Jun. 28 | Easton, Edward | 3, Whitehall Place, S.W. |
| 1874, Apr. 27 | Edwards, John, Q.C. | 1, Harcourt Buildings, Temple. |
| 1877, Apr. 16 | Edwards, John Frederick James | Chapel Brampton, Northumberland. |
| 1869, Feb. 8 | Fawcett, James Pogue | 5, Lancaster Place, W.C. |
| 1869, Feb. 22 | Fowler, John | 2, Queen Square Place, S.W. |
| 1878, Feb. 11 | Freeman, George Mallows | 11, King's Bench Walk, Temple. |
| 1878, Mar. 11 | Freshfield, Edwin | 5, Bank Buildings, E.C. |
| 1876, Mar. 20 | Freshfield, William Dawes | 5, Bank Buildings, E.C. |
| 1877, Mar. 12 | Fulton, Hamilton | 7, Vigo Street, Regent Street, W. |
| 1868, Jul. 27 | Garrard, Arthur | 17, Finsbury Square, E.C. |

| *Date of Election.* | ASSOCIATES. | |
|---|---|---|
| 1876, Dec. 18 | GEDGE, SYDNEY . . . . . | 1, Old Palace Yard, S.W. |
| 1872, Apr. 8 | GEPP, THOMAS MORGAN . . . | Chelmsford, Essex. |
| 1874, Feb. 16 | GOLDNEY, GABRIEL PRIOR . . | 3, Essex Court, Temple, W.C. |
| 1877, Feb. 12 | GOTTO, FREDERICK EDWARD . | Ely, Cambridgeshire. |
| 1869, Jan. 11 | GRANTHAM, RICHARD BOXALL . (*Associate of Council*) | 22, Whitehall Place, S.W. |
| 1874, Jan. 5 | GRANTHAM, RICHARD FUGE . . | 22, Whitehall Place, S.W. |
| 1877, Mar. 26 | HARDING, EDWARD ERNEST . | 16, St. Paul's Churchyard, E.C. |
| 1877, Mar. 26 | HARDING, WILLIAM DANIEL, JUN. | 16, St. Paul's Churchyard, E.C. |
| 1878, Jan. 28 | HARRINGTON, GEORGE FREDERICK | 17, New Bridge Street, Blackfriars, E.C. |
| 1876, Dec. 18 | HARRISON, WILLIAM GEORGE, Q.C. . . . . | 11, King's Bench Walk, Temple. |
| 1875, Dec. 13 | HIGGIN, WILLIAM HOUSEMAN, Q.C. . . . . | 4, St. James' Square, Manchester. |
| 1875, Jan. 4 | HILL, ALEXANDER STAVELEY, Q.C., M.P., &c., &c. . . . | 3, Garden Court, Temple; and Oxley Manor, Stafford. |
| 1870, May 23 | HOLLWAY, JOHN GEORGE . . | Lamb Building, Temple, W.C. |
| 1868, Jul. 20 | HORSLEY, RICHARD . . . . | 11, Bull-and-Mouth Street, E.C. |
| 1869, Feb. 8 | HUBBERSTY, HENRY ALFRED . | Buxton, Derbyshire. |
| 1873, Feb. 10 | INGRAM, WALTER FEILDE . . | 89, Chancery Lane, W.C.; and Firle, Lewes. |
| 1870, Jan. 24 | JOHNSTON, ANDREW . . . . | 97, Gresham Street, E.C. |
| 1875, Dec. 13 | KAYE, JOHN EDWARD . . . | 97, Gresham Street, E.C. |
| 1870, May 23 | KEELE, EDWARD RUSHWORTH . | 5, Frederick's Place, Old Jewry, E.C. |
| 1873, Apr. 21 | *KING, WILLIAM . . . . . | Gas Office, Duke Street, Liverpool. |
| 1874, Feb. 2 | LEDGARD, FREDERICK THOMAS DURELL . . . . . | 4, Elm Court, Temple, W.C. |
| 1868, Jul. 6 | LEE, CHARLES WILLIAMS . . | 8, Adelphi Terrace, W.C. |
| 1876, Apr. 3 | LEE, GEORGE CANSFIELD . . | North Eastern Railway, York. |
| 1873, Jan. 27 | LERMIT, ALFRED WILLIAM . . | 32, Bedford Row, W.C. |
| 1874, Feb. 16 | LITTLER, RALPH DANIEL MAKINSON, Q.C. . . . . | 1, Plowden Buildings, Temple, W.C. |
| 1869, Mar. 4 | LOTT, JOSEPH . . . . . | 19, Great George Street, S.W. |
| 1877, May 18 | LUCAS, JOSEPH . . . . . | Tooting Graveney, S.W. |
| 1876, Jan. 15 | MARRIOTT, GEORGE WHARTON . | Horstead, Norwich. |
| 1874, Feb. 16 | MARRIOTT, WILLIAM THACKERAY, Q.C. . . . . | 6, Crown Office Row, Temple, W.C. |

| *Date of Election.* | ASSOCIATES. | |
|---|---|---|
| 1876, Nov. 13 | MARTIN, CHARLES WILLIAM | Barrow-on-Soar, near Loughborough, Leicestershire. |
| 1878, May 13 | MAUGHAN, JOSEPH HENRY | 9, New Street, Great Grimsby. |
| 1878, Jan. 28 | MESTON, JOSEPH FYFE | 20, Spring Gardens, S.W. |
| 1875, Jan. 4 | MICHAEL, WILLIAM HENRY, Q.C. | 1, Park Prospect, St. James's Park, S.W. |
| 1869, Jan. 25 | NASH, ALFRED JAMES | Farnham, Surrey. |
| 1875, Dec. 13 | NEVILE, HENRY WILLIAM | Broughton Estate Office, 8, John Dalton Street, Manchester. |
| 1875, Feb. 1 | NEWMAN, GEORGE GUNNELL | 75, Cornhill, E.C. |
| 1874, Feb. 2 | NIXON, SAMUEL | 29, Great George Street, S.W. |
| 1878, Feb. 11 | NORRIS, WALTER HENRY | Alban Villa, Watford, Herts. |
| 1875, Nov. 8 | PAIN, COARD SQUAREY | 4, Cook Street, Liverpool. |
| 1876, Apr. 24 | PARKER, FREDERICK SEARLE | 17, Bedford Row, W.C. |
| 1875, May 10 | PAYNE, WILLIAM PERCY | Midland Railway Station, Derby; and 136, Mansfield Road, Nottingham. |
| 1872, Nov. 11 | PAYNE, WILLIAM SETH ROBERT | 141, Fenchurch Street, E.C. |
| 1869, Dec. 6 | PETRE, HENRY WILLIAM, THE HON. | Springfield, Chelmsford, Essex. |
| 1869, Feb. 22 | PHILBRICK, FREDK. ADOLPHUS, Q.C. (*Associate of Council*) | Lamb Building, Temple. |
| 1875, Jan. 4 | PLEDGER, JOSEPH AUGUSTUS | Great Baddow, Chelmsford. |
| 1874, Feb. 16 | POWELL, REGINALD HENRY | Lewes, Sussex. |
| 1871, Feb. 27 | QUICK, JOSEPH, JUN. | 29, Great George Street, S.W.; and Sumner Street, Southwark, S.E. |
| 1868, Nov. 9 | REES, JOHN CHARLES | 13, Great George Street, S.W. |
| 1869, Feb. 8 | REX, WILLIAM | 311, Kentish Town Road, N.W. |
| 1876, May 8 | RICH, ROBERT | Sarsden Estate Office, near Chipping Norton, Oxfordshire. |
| 1876, Jan. 24 | ROBERTS, CHARLES | 3, Upper Montague Street, Russell Square, W.C. |
| 1874, Feb. 2 | ROBERTS, CHARLES GAY | Haslemere, Surrey. |
| 1874, Mar. 2 | ROGERS, SYDNEY JAMES | 5, Westminster Chambers, S.W. |
| 1876, Dec. 18 | RYDE, ARTHUR LYON | 29, Great George Street, Westminster, S.W. |
| 1875, Nov. 8 | RYDE, EDWARD HARROW | 60, Warwick Square, S.W. |
| 1871, Feb. 13 | SHIELD, HUGH | 3, King's Bench Walk, Temple. |
| 1877, Jan. 29 | SHOPPEE, CHARLES HERBERT | 61, Doughty Street, W.C. |
| 1878, Feb. 11 | SHOPPEE, CONRAD JOSEPH | 61, Doughty Street, W.C. |
| 1876, May 8 | SMITH, HENRY | 8, John Street, Adelphi, W.C. |
| 1875, Apr. 26 | SMITH, HENRY HERBERT | 6, Whitehall, S.W. |
| 1868, Jul. 27 | SMITH, HERBERT EDMUND | Darlington, Durham. |
| 1878, Apr. 8 | SMITH, JOHN SMALMAN | 3, Hare Court, Temple. |
| 1869, Jan. 11 | SMITH, WILLIAM BINNS | 50, Pall Mall, S.W. |

| *Date of Election.* | ASSOCIATES. | |
|---|---|---|
| 1868, Nov. 9 | SMYTH, EDWARD . . . . . | 9, Whitehall Place; and 100, Stockwell Park Road, S.W. |
| 1878, Mar. 25 | SQUAREY, TUCKER FULTON . . | Higher Bebington, near Birkenhead. |
| 1876, Mar. 20 | ST. QUINTIN, RICHARD SAMUEL | 37, Threadneedle Street, E.C. |
| 1875, Dec. 13 | STRUTT, EDWARD GERALD, THE HON. . . . . | Terling Place, Witham, Essex. |
| 1875, Jan. 4 | STRUTT, FREDERICK, THE HON. | 88, Eaton Square; and Milford House, Derby. |
| 1877, Dec. 10 | SUTTON, HENRY . . . . . | Farrar's Building, Temple. |
| 1869, Jul. 26 | TAYLOR, GEORGE. . . . . | Tithe and Inclosure Commission Office, St. James's Square. |
| 1872, Mar. 11 | TAYLOR, JOHN . . . . . | Earsdon, Northumberland. |
| 1876, May 8 | THESIGER, THE RIGHT HON. LORD JUSTICE . . . . | 30, Stanhope Gardens, S.W. |
| 1870, Feb. 21 | THOMPSON, CHARLES WILLIAM . | Vacant Lands' Office, Guildhall, E.C. |
| 1878, Apr. 8 | THOMSON, JAMES ALFRED . . | Woodside, Wimbledon. |
| 1871, Feb. 13 | TOLMÉ, JULIAN HORN . . . | 1, Victoria Street, Westminster, S.W. |
| 1874, Apr. 27 | TREVELYAN, HARINGTON ASTLEY, COL. . . . . | Sandrock Villa, 5, Elm Tree Road, N.W. |
| 1868, Jul. 20 | TROLLOPE, GEORGE FRANCIS . | 15, Parliament Street, Westminster, S.W. |
| 1874, Jan. 19 | USILL, GEORGE WILLIAM . . | 3, Great Queen Street, Westminster, S.W. |
| 1873, Dec. 8 | VENABLES, FREDERICK . . . | Hadley, Barnet. |
| 1878, Jan. 28 | VIGERS, LESLIE ROBERT . . | 4, Frederick's Place, Old Jewry, E.C. |
| 1876, Dec. 18 | WATTS, CHARLES . . . . | 37, Great George Street, Westminster, S.W. |
| 1876, Nov. 27 | *WEBSTER, RICHARD EVERARD, Q.C., | 2, Pump Court, Temple. |
| 1871, Feb. 13 | WHITE, FREDERICK MEADOWS, Q.C., | 4, Paper Buildings, Temple. |
| 1873, Jan. 27 | WHITE, THOMAS JENNINGS . . | 8, Whitehall Place, S.W. |
| 1876, Dec. 18 | WILL, JOHN SHIRESS . . . | 3, Pump Court, Temple. |
| 1875, Jan. 18 | WILLIAMS, LEONARD JAMES . | 6, Furnival's Inn, E.C. |
| 1869, Apr. 5 | WILLIAMS, RICHARD PRICE . . | 38, Parliament Street, S.W. |
| 1876, Apr. 3 | WILLIAMS, WILLIAM WELSBY . | West Street, Farnham, Surrey. |
| 1877, Jan. 29 | *WILSON, RODERIC JOHN . . | 24, Old Square, Lincoln's Inn, W.C. |
| 1869, Dec. 6 | WILSON, WILLIAM . . . . | 13, Dean's Yard, S.W. |
| 1870, Jan. 10 | WING, THOMAS TWINING . . | 17, Woburn Square, W.C. |
| 1875, May 15 | WINCKWORTH, LEWIS . . . | 31, Abingdon Street, Westminster, S.W. |
| 1876, Feb. 7 | WOOLLEY, THOMAS CECIL SMITH | South Collingham, Newark, Notts. |
| 1876, Apr. 24 | WYATT, ROBERT . . . . . | Acton Hill, Stafford. |

## Students.

| *Date of Admission.* | | |
|---|---|---|
| 1876, Jul. 13 | BURMESTER, JOHN WILLIAM STANLEY . . . . . | 4, Spencer Villas, Southfields, Wandsworth. |
| 1877, May 14 | COSENS, ALAN . . . . . | 10, Palace Road, Upper Norwood, S.E. |

| *Date of Election.* | STUDENTS. | |
|---|---|---|
| 1875, Feb. 26 | DRIVER, ROBERT MANNING . | Melrose House, Cromwell Rd., S. Kensington, S.W. |
| 1876, Nov. 27 | EILOART, FREDERICK EDWARD. | 40, Chancery Lane, W.C. |
| 1875, May 31 | LLOYD, GEORGE . . . . . | 50, Laurel Grove, Penge, Surrey. |
| 1876, Nov. 13 | NEWMARCH, BERNARD . . . | 32, Bedford Row, W.C. |
| 1876, Nov. 27 | PAULL, HENRY BAYNHAM . . | 6, Wellington Square, King's Road, Chelsea. |
| 1875, Feb. 1 | SMITH, GEORGE CECIL . . . | 16, Whitehall Place, S.W. |

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Members and Associates are particularly requested to communicate any changes of address to the Secretary, in order to obviate delay in the transmission of the Papers, &c., to which they are entitled.

END OF VOL. X.

BIBL. LONDIN. UNIV.